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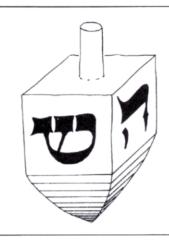
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80 formats its program listings to run 64 characters wide, the way they look on your video screen. This accounts for the occasional wrap-around you will notice in our program listings. Don't let it throw you, particularly when entering assembly listings.

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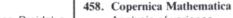
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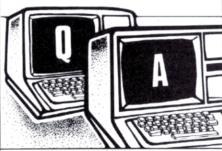
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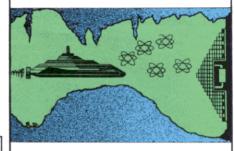
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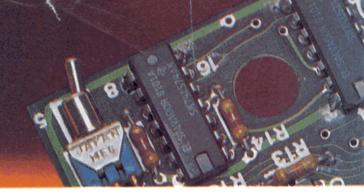
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With the virtual demise of CB, a serious loss of consumer interest in hi-fi, and the overall slowdown in the buying of electronic gadgets, Radio Shack stores have found that they are more and more dependent on their computer products. It is not much of an exaggeration to put this bluntly: as go computer sales, so goes Radio Shack.

So how go the computer sales?

Starting with the Color Computer, Radio Shack's low-end system aimed at the home computer market, it's bad news. When the Shack was up against small firms selling high-priced products, their 6,400 stores gave them an unbeatable edge. Even today, with less than 5,000 bona fide computer stores, even if a rival firm managed to get 100 percent penetration of this distribution system, they would still not quite match the Shack.

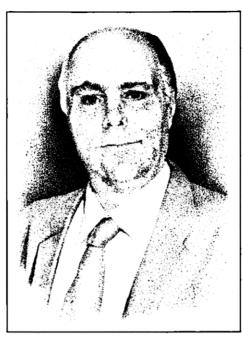
But home computers are not dependent on computer stores. The lowend computer systems are being sold through toy stores, discount stores, department stores, electronic stores, and so on. The Shack has been overwhelmingly outnumbered in sales outlets—and in sales. Atari, Texas Instruments, and Commodore are all beating the hell out of the Shack in the home market.

This volume of sales has, in turn, allowed the firms to undercut the Shack in price. This further is hurting the Shack.

Shack is trying, belatedly, to develop some sales through RCA outlets for the CoCo, but the neglect of this system in many ways, as I've griped about before, may now have dealt them out of the fast-growing home-computer market as a major participant.

The Shack brought out CoCo in August 1980 and then virtually abandoned it. Either unable or reluctant to get enough of the right people on the Shack staff to handle the multiplying problems of changing from the Model I to the Model III, plus endless aggravation with the Model II, the CoCo and the pocket computers were announced, put into the catalogs, and left to fend for themselves.

So here we are two years later—a lifetime in the microcomputer industry—with a pitiful lack of serious support for the system. It seems that the



# Is the Shack in real trouble?

Shack people are at war with their supporters and potential suppliers. On the one hand, perhaps from a desire to make every possible dollar of profit, they try to do as much as possible inhouse. But even when they see that this is pushing them further and further behind, they don't change their policies. Having worked with the Shack for many years, I get the idea that once a policy is made it is put into concrete and no amount of disasters is going to change policy.

I'm sure there are at least fifty software firms out there that would love to work with the Shack to develop the needed software for CoCo. I know that our Instant Software people have at least 500 programs that could be converted to run on the system, and which they have tried to talk with the Shack about. I've talked with many hardware accessory people who have similarly been frustrated in trying to talk with the Shack.

It is getting clearer that home com-

puters will eventually take over the video game market, allowing people to play all of the games...and also run home programs, educational programs, and so on. On that basis, is there anything that the Shack can do to cope with this growing market, and get back into competition?

Yes...and no. Yes, of course the Shack can do it—but no, not without breaking some serious concrete decisions. They've erected their own Great Wall between continued growth and gradual decline.

As the messenger I expect that I will be skinned alive, as I have in the past. They sure don't like messengers.

#### The Software

By making the CoCo incompatible with all their other Shack computers. they set themselves up with a major problem-no software. The Shack's normal approach is to hire some programmers and get the software written. But here there is a little problem. Even the massive Shack resources aren't enough to hire very many programmers. These days, programmers with any creativity and experience can sit at home anywhere they want and make all the money they need. Who needs to move to Fort Worth, where for about half the year you either have an air conditioner handy or you melt? I lived there one summer, so I know!

Most of the better programmers are writing programs and getting them distributed through software houses and are not even remotely interested in sweat-shop, regimented nine-to-five jobs...jobs where one can be fired as soon as a temporary problem has been surmounted.

The Shack has done the best it could to find programming talent to grind out software, and the results, as reviews of the Shack software make all too clear, are disappointing. It is getting time to face up to the failure of this system of trying to cut corners on costs, always trying to get a few pennies' more profits to drive up the quarterly stockholder reports.

If the Shack would start dealing honestly and forthrightly with some of the software suppliers to the industry, I think they could get plenty of software to support the CoCo—and that certain-

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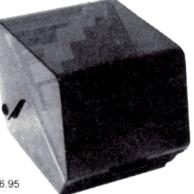
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ly is an important first step. They should have done this two years ago.

Another cherished policy of the Shack that needs to be re-examined, as I mentioned a few months ago, is the one about their stores carrying only the fastest selling products. In the case for software, this may be a self-defeating policy.

In the consumer-products market, perception of the product is paramount. The computer that is backed up by a display of a barrage of software is going to be more impressive than the one with a dozen or two programs. Sure, over 90 percent of book sales are made by a couple of dozen titles, but you never see a serious book store that does not have thousands of books.

The consumer this Christmas is going to have to choose among the Atari-400, the TI 99/4A, the Commodore VIC-20, the Commodore Max, the Timex-1000, and the TRS-80 Color Computer. The Shack realizes that they are going to have to cut prices from the present \$400 range down to at least \$300. This still is going to be a difficult sale for them against the \$189 VIC-20 or the Atari-400 at \$299 plus \$60 in software coupons. The TI, with their \$100 rebate, is in the \$200 range.

It's far too late to do anything for this Christmas season, but the Shack could get started on a plan that would, by Christmas 1983, put them into a leadership position. This would call for some serious changes of policy and for a good deal of long-range planning.

If you look through 80 Micro, you see how much can be developed in the way of supporting industry for a system. Well, with cooperation (a concept I don't think is in the Shack dictionary), this industry would jump at the chance to support the CoCo. What would be the impact on consumer sales if the Shack had a home-computer system with a massive amount of software supporting it? What would be the result if it was also supported by the enormous accessory and peripherals industry that has sprung up around the TRS-80 system?

You can bet that Atari, TI, and Commodore would be scurrying fast to try to keep up. The Shack would have the edge in this case because a whole industry has already sprung up to support the TRS-80 by virtue of 80 Micro, while there is relatively little support for the other home computer systems, since no media such as this magazine exist to bring on growth. The Shack would be starting with a good lead in this case.

The next step, if I were working on the project, would be to separate the toy department of the Radio Shack stores from the home computer department. I would set up a separate home computer boutique in every Tandy-owned store where I would feature the CoCo, its accessories and software, plus the Model III and pocket computers. I would relegate the Model II to the Tandy Computer Centers. Go with strength.

It is at least worth a try in a few stores to see what impact this sort of

marketing might have. The Shack still has a long way to go to convince the middle-income (-class) customers that Radio Shack stores are not primarily dealers in schlock for the unwary lower-income people. By separating the home computers from their flashlights, ineffectual radar detectors, lo-fi audio systems, and so on, it might be possible to build some middle-income consumer confidence in the computer products.

I think it would work.

Once they've worked out a successful home-computer boutique formula for their own stores, they can start putting these into independent Radio Shack stores, thus adding another 2,000 or so outlets for the product.

That still isn't going to match the marketing might of Atari and the others, but with a successful home-computer boutique formula, they would be ready to set these up in *any* discount store or department store interested in a profit center. They would have the whole miniature store instead of some shelves of products, as a unit ready to franchise.

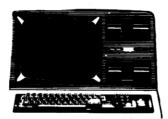
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do boat navigation? No problem. All of the accessories and software would be integrated and packaged.

But what about training salesmen? That's one of the weakest aspects of the Shack stores right now. In fact, I suspect that this problem alone has kept most of the independent Shack stores from really participating in the bonanza so far. You didn't think I was going to ignore such a key problem, did you? The answer is simple, once you think of it.

Video disks. Yep! With disk players dropping in price, I would run, not walk, to my nearest video production organization and put together powerful video programs that show what the Co-Co, Model III, and pocket computers can do. They would be indexed to show off all the accessories and software, and show the use of the systems for playing games, for business applications, education, scientific, control, and so on. With the video disk and a control CoCo in the salesroom, the customer would be able to delve into the possibilities of the systems with no trained sales help needed.

In this way the best demonstrator of the Shack system in the world could do the selling to every prospect. Further, the buying process in itself would be fun. Further, there would be no end to the sales to every customer. He might buy the basic computer and a couple of programs the first time around, but he'd be back regularly to check out more and more applications...and fun...for his system. It is fun to buy things...and fun to use them and show them off to friends. Who has ever bought a car and not started looking for gadgets to buy for it? Who has bought a camera and not looked for more lenses, special films, and so on?

If the Shack can show that a 200-square-foot home-computer boutique can make more profit than other uses of that space, you can bet that Sears, Lechmere, K-Mart, and other stores will be putting 'em in as fast as they can. And if they can't make big profits in a fast growing field—a go-go field—on home computers, then the Shack needs better management.

I'm reminded of the basic problem that Heath faced when they brought out their computer in 1977. They had about 50 stores around the country and they had decided to make do with this distribution. I tried hard to convince them that in the microcomputer field it was

marketing and distribution, not the magnificence of the computer, that would determine the winners and the losers. I wanted them to open up their sales to computer stores, electronics stores, and so on, so they would have a better chance at making their system available in all of the marketing areas of the country.

The Shack had a considerable advantage over everyone else in the micro business by virtue of their thousands of stores. This, plus their advertising budget, helped them get into first place in microcomputer sales...shooting them ahead of Heath. But today, particularly on the low end, the Shack is falling way behind in sales outlets and thus in sales. There is a good chance that if the Shack does not respond fast to this deteriorating situation, they will just have to abandon the low end and the CoCo. This could play hell with the Tandy stock prices...and shake up management.

Well, at least the Shack is going strong with their main entry, the Model III, right? Yeah? If that is so strong, why do the 80 Micro reader surveys show that 50 percent of the readers are thinking of buying something other than a TRS-80 for their next computer? This indicates some very deep-rooted and widespread disenchantment with the Shack, something that the Shack management seems to be trying its best to ignore.

Indeed, we've seen the Apple come along and, with fewer outlets, pass the TRS-80 by in sales. And while TRS-80 owners are generally happy with their systems, the Apple owners are almost evangelical about theirs. In this I suspect that the core, if you'll pardon the expression, lies in the way the firms support their systems. Where Apple has been very supportive of the industry that has sprung up around their computer, we find the Shack seeming to begrudge any sale not made by them and them alone.

When the Shack puts on a computer show, there are no supporting hardware firms invited...no software firms exhibiting...no magazines and books. When Apple organizes an Applefest, supporting firms are not only invited to display, they are encouraged in many ways.

There are many good books on the TRS-80 that are not permitted in the Shack stores. There are thousands of that can only lead to disaster.

good software programs...a wealth of support hardware items. In each case, the Shack seems to be doing its best to keep news of these products from its customers, apparently wanting to do everything it can to be sure to get every nickel spent for anything related to the TRS-80 for themselves.

No matter the intent of management, this is the view of many users (and Radio Shack managers), so if there is a misinterpretation of intent, there is a serious lack of communication. Indeed, many TRS-80 owners have a sour view of Radio Shack, seeing the firm as the epitome of the big company that is contemptuous of its customers and the general public. It is difficult to interpret many of their actions in any other way.

Whether Apple pulls further ahead and IBM passes the Shack by depends on decisions made in the Tandy Towers this year. It is already late in the game, but not too late. The Shack could pull it together and get powered up to regain a strong market share of the home-computer market by the end of 1983. They could stop the attrition of their sales in the small business computer market. But these things are going to take some soul-searching, perhaps painful, decisions. They are going to call for some major changes of approach and the breaking of hardened Shack policies.

With such a high percentage of the Tandy sales being involved with the TRS-80, and with many of the other products being so weak in sales, there is a serious question about the survival of Tandy should the TRS-80 sales start to weaken.

In early 1977 Mits was thoroughly in command of the microcomputer industry. They were as far or further ahead of the rest of the industry as Radio Shack was in 1980. Then, but two years later, Mits had been swallowed up by Pertec and virtually disappeared from the scene. Pertec could easily have remained the top firm in the industry if management had not made one disastrous decision after another.

Next, it was Imsai that was on top of the heap...then Processor Tech. Each pulled some market miscalculations and major blunders that sank them. The big question, then, is whether the Shack can cure its problems and get back to its number one position again, or whether it is going to continue to lose sales and market share on all fronts, a process that can only lead to disaster.

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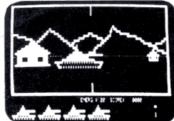
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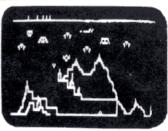
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- + Features the famous Atari Joystick
- Works with all Model I or III systems
- + Compatible with any other accessories
- + Saves your keyboard from abuse + Experiment in BASIC Use A = INP(0)
- + Complete, ready to plug in and use
- Model I. plugs into KB or E/I
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Price includes Joystick + Alpha Interlace + Instructions + Demo Program listing. Please specify Model i or III.

14 DAY MONEY BACK GUARANTEE

4201



### DEFENSE COMMAND The invaders are back! Alone, you

defend the all important nuclear fuel canisters from the repeated attacks of thieving aliens, repeatedly. An alien passes your guard, snatches a canister and flys straight off. Quick! You have one last chance to blast him from the sky! With sound and voice.



#### CRAZY PAINTER

You have to paint the floor white. We give you the paint and brush. Sounds easy? Hah! You'll be confounded by stray dogs, snakes, sloshing buckets of turpentine, even a ravenous "paint eater." A crazy, imaginative new game with ten selectable levels of skill for new or seasoned game players. Lot's of laughs. Price: A



4025

#### SUPER NOVA

Asteroids float ominously around the screen. You must destroy the asteroids before they destroy you! (Big asteroids break into little ones). Your ship will respond to thrust, rotate, hyperspace and fire. Watch out for that saucer with the laser! As reviewed in May 1981 Byte Magazine. Price: A

#### METEOR MISSION II

As you look down on your view, astronauts cry out for rescue. You must maneuver through the asteroids and meteors. (Can you get back to the space station?) Fire lasers to destroy the asteroids, but watch out, there could be an alien Flagship lurking Includes sound effects! Price: A

#### **OUTHOUSE**

You are the mighty protector of this small (but important) wooden structure. For reasons unknown, a bizarre gang of miscreants wish to vandalize, loot and otherwise destroy the little "half moon house." Your patrol craft has lasers and smart bombs to deal with this terror. From SSM with sound. Price: A



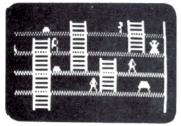
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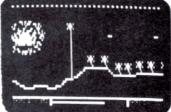
#### **GAME PRICES**

A: TAPE: \$15.95 • DISK: \$19.95 B: TAPE: \$19.95 • DISK: \$24.95 C: TAPE: \$24.95 • DISK: \$24.95



#### PANIK

Trapped at an enemy building site, your fate seems certain. Your laser is empty and evil Mzors are closing in. You'll have to climb ladders and think one step ahead of the various monsters. A challenging game for agile minds. From Fantastic Software with voice (Disk has larger vocabulary). Price: B



#### **SEA DRAGON**

Your submarine, the U.S.S. Sea Dragon, penetrates a mined enemy channel. Armed with missiles and torpedos, you engage the enemy while navigating unknown waters. Succeed or come to a salty end in this game. 29 screens of horizontally scrolling seasorape and sound from Adventure International, Price: B



#### THE BEST FOR LESS

As you can see, all the best games from the top producers are joystick compatible. These games are fun without the joystick but we hope that you are one of the many thousands who enjoy the advantage of real joystick action.

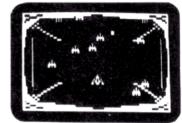
Now you can deduct up to 20% on the price of games: buy any 2 games deduct 10%, buy any 3 games deduct 15%, buy any 4 games deduct 20% from game prices.

#### TOP TEN

- 1. SCARFMAN . All time favorite
- 2. ARMORED PATROL Super 3D graphics
- 3. PENETRATOR · Rave reviews
- 4. STELLAR ESCORT Fast and Challenging
- 5. CRAZY PAINTER Unique game concept
- 6. PANIK Remarkable Voices
- 7. DEFENSE COMMAND Tough struggle
- 8. CATERPILLAR Good rendition
- 9. ROBOT ATTACK With voice
- 10. SEA DRAGON · Amazing "Seascape"

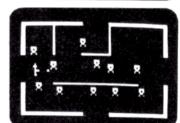
#### STELLAR ESCORT

The latest super action game from Big Five. As the Federation's top space fighter you've been chosen to escort what is possibly the most important shipment in Federation history. The enemy will send many squadrons of their best fighters to intercept. With sound. Disk version has voices. Price: A



#### ROBOT ATTACK

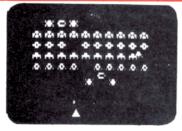
Talks without a voice synthesizer, through the cassette port. With just a hand laser in a remote space station, you encounter armed robots. Some march towards you, more wait around corners. Careful, the walls are electrified. Zap as many robots as you dare before escaping to a new section. More robots await you. Price: A



#### LUNAR LANDER

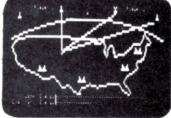
As a vast panoramic moonscape scrolls by, select one of many landing sights. The more perilous the spot, the more points scored — if you land safely. You control LEM main engines and side thrusters. One of the best uses of TRS-80 graphics we have ever seen. From Adventure International. With sound. Price: A





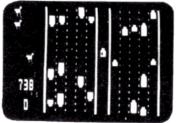
#### **GALAXY INVASION**

The sound of the klaxon is calling you! Invaders have been spotted warping toward Earth. You shift right and left as you fire your lasers. A few break formation and fly straight at you! You place your finger on the fire button knowing that this shot must connect! With sound effects! Price: A



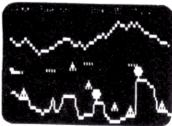
#### LASER DEFENSE

In this game of ICBM's, high-energy lasers and particle beams, you control the U.S. strategic defense satellite system. From your viewpoint high above the globe, you intercept Soviet nuclear missiles in flight and attempt to destroy their scattered missile silos. With sound from MED Systems.



#### CHICKEN

Will the chicken cross the road? That's up to you. Can you guide these helpless little chicks across the perilous 10 lane super highway to safety? Or will you bumble, littering the blacktop with a storm of chicken feathers? A humourous yet challenging game of nerves from SSM with sound. Price: A



#### PENETRATOR

Soar swiftly over jagged landscape, swooping high and low to avoid obstacles and enemy missiles attacks. With miles of wild terrain and tunnels to penetrate, you're well armed with bombs and multiple forward missile capability. From Melbourne House. Features sound, trainer mode and customizing program. Price: C



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### PROOF NOTES

#### The editors look at the issues

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1982 hasn't even run its course, and we're already well into production for the first half of 1983. So far, it looks like we're going to have another interesting year.

January will feature one of the most exciting programs we've ever run—Bruce Tonkin's The Creator. This program generator originally sold for \$295, but mayhem and misfortune led Tonkin to decide to virtually give his brain child away. This could very well be the best software bargain you'll ever get, commercial or otherwise.

February's highlight will be the results of our Young Programmer's Contest. We're getting buried under entries, and we'll be publishing the best ones. We've been agog at what kids are doing with computers, and are looking forward to displaying the fruits of their labors. February will also concentrate on home education. We've lined up a Color Computer College Bowl, a preschool math program, a spelling challenger, and a states-and-capitols drill.

March is our hardware construction issue. We've had lots of requests for some meaty hardware projects, so we went out and found some gems. For starters, we've got a \$5 CP/M kit for the Models I and III. We'll also show you how to build a credit-card reader that will act as a security lock for your micro. We're also working on a primer that will tell you how to build hardware projects even if you don't know which end of a soldering iron to hold.

April will focus on micros in sports, and will also feature articles on computer languages other than Basic. May's cover topic will be graphics—simple techniques for fancy graphics, and incorporating graphics into applications programs. June will provide programs and articles aimed at the professional. July's theme will be the Color Computer, and August will, of course, be our annual games issue.

Also, you Model II owners will be happy to know that we're working on a scheme to convert some of our Model I/III programs to your machine. And, of course, we'll continue our increased

# Ready to go for another big year

coverage of the Color Computer.

We've got several new series and columns on tap. One will be an on-going tutorial on cryptography, while another will discuss integrating machine-language routines into your Basic programs. In addition, many of our regular columns will be back for another year, including J. M. Keynes' "MONEY DOS," Richard Ramella's "Fun House," Philip Mills' "Medical Opinion," and Dennis Kitsz's "80 Applications."

The magazine isn't all we're working on, either. We're putting together a new series of low-budget handbooks on a variety of themes. The first will be an anthology of Scripsit mods. Other subjects include home management, astronomy, and education. We haven't set a publication date yet, but look for these handbooks soon.

All in all, we think it's going to be an exciting year. Stick around and join the fun.

You might have noticed some recent format changes in the magazine. We're going to an English Times typeface, which we think is more attractive and easier to read than Helios. For a while, though, you're going to see the two typefaces mixed, as we use up articles that were finished before the change. Bear with us if we look a bit motley.

#### Subscriptions:

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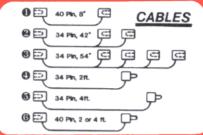
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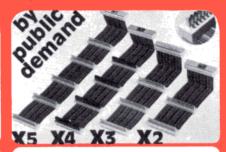
-E.M.

#### NOW MODEL I

Now Model III users can take advantage of the ALPHA I/O system too. Our new MOD III/I BUS CONVERTER allows most port based Model I accessories (such as our ANALOG-80, INTERFACER 2 and INTERFACER-80) to connect to the Model III bus, MOD III/I BUS CONVERTER, complete with all connectors, only \$39.95.







Have 2 printers on line at all times and select printer 1 or 2 by means of a conveniently located switch. End the problem of constantly plugging and unplugging printer cables. PRINT-SWITCH is a compact module that plugs onto the parellel printer port of your TRS-80 and provides an edge connector for each of your two printers. It works with any two types of printers dot matrix, daisy wheel, plotters, TRS-80 converted selectrics, etc. Assembled, tested, ready to use with connector and instructions. For Model I or III (please specify). ONLY.. \$59.00

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#### ANALOG-80: A WORLD OF NEW APPLICATIONS POSSIBLE

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Resolution 20mV (on 5V range) Accuracy 8 bits (5%) Port Address jumper selectable Plugs into keyboard bus or £/l (screen printer port). Assembled and tested 90 day warranty omplete with power supply, connector, manual



Keeps quartz accurate time for 3 years on 2 replaceable AAA batteries (not included). Gives MO/DATE/YR, DAY of WEEK. HR MIN SEC and AM/PM Features INTELLIGENT CALENDAR and even provides for Leap Year. This compact module simply plugs into rear of Keyboard or side of Expansion Interface (may be slipped inside E/I). Includes cassette software for setting clock and patching to any DOS (including NEWDOS 80 2 01 Optional "Y" connector allows for further expansion. For Model 1 Fully assembled and tested. Complete with instructions and cassette. ONLY \$95.00 "Y" option, add \$12.00



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#### **GREEN SCREEN** WARNII

IBM and all the "biggies" are using green screen monitors Its advantages are now widely advertised. We feel that every IRS-80 user should enjoy the benefits it provides But WARNING: all Green Screens are not created equal. Here is what we found:

 Several are just a flat piece of standard colored Lucite. The green tint was not made for this purpose and is judged by any to be too dark. Increasing the brightness control will result in a fuzzy display

Some are simply a piece of thin plastic film taped onto a cardboard frame. The color is satisfactory but the wobbly film ves it a poor appearance

•One "optical filter" is in fact plain acrylic sheeting

 False claim: A few pretend to "reduce glare". In fact, their flat and shiny surfaces (both film and Lucite type) ADD their reflections to the screen.

•A few laughs: One ad claims to "reduce screen contrast" Sorry gentleman but it's just the opposite. One of the Green Screen's major benefits is to increase the contrast between e text and the background.

 Drawbacks: Most are using adhesive strips to fasten their screen to the monitor. This method makes it awkward to remove for necessary periodical cleaning. All (except ours) are flat. Light pens will not work reliably because of the big gap between the screen and the tube

Many companies have been manufacturing video filters for years. We are not the first (some think they are), but we have done our homework and we think we manufacture the best

Green Screen. Here is why.

It fits right onto the picture tube like a skin because it is the only CURVED screen MOLDED exactly to the picture tube curvature. It is Cut precisely to cover the exposed area of the picture tube. The fit is such that the static electricity is sufficient to keep it in place! We also include some invisible reusable tape for a more secure fastening

The filter material that we use is just right, not too dark nor too light. The result is a really eye pleasing display

We are so sure that you will never take your Green screen off hat we offer an unconditional money-back guaranty: try our Green Screen for 14 days. It for any reason you are not lighted with it, return it for a prompt refund.

A last word: We think that companies, like ours, who are selling mainly by mail should elist their street addressehave a phone number (for questions and orders) accept CODs. not every one likes to send checks to a PO box+offer convenience of charging their purchase to major credit cards. Order your ALPHA GREEN SCREEN today...\$12.50

ALPHA Products

ADD \$2.50 PER ORDER FOR SHIPPING AND HANDLING ALL ORDERS SHIPPED FIRST CLASS MAIL.
WE ACCEPT VISA. MASTER CHARGE. CHECKS. M.O. COD: ADD \$2.00 EXTRA. OUANTITY DISCOUNTS AVAILABLE.
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#### **Magazine Mystery**

When 80 Micro was advertised, I decided to become a charter subscriber. On November 20, 1979, I sent off my check for \$36 and eagerly waited for the first issue and the book of 80 programs. They never came!

Then, the February 1980 issue came. I was elated. Then the March issue arrived. I wrote for and received the book of 80 programs but still no January issue. I wrote to Wayne Green and soon the January issue arrived, but no letter of acknowledgement. I got my magazine so I didn't care: my problem was solved.

#### Wait!

No April issue. I wrote the subscription service. No reply, no magazine. I moved to my current address. I sent in a change of address. I wrote to the subscription service. No reply, no magazine. No big deal: I bought the magazine at the local hobby shop. No June issue, so I wrote the subscription service again. No reply, no magazine. I received the April issue as a forwarding from my prior address by the post office. Now I understood—it just took a little time to get things unraveled.

#### Wait!

No July issue, so I wrote the subscription service. No reply, no magazine. In August, I decided that this 50-mile trip to the hobby shop each month was becoming a pain, so I decided to send money for a new subscription and mark off the other money to experience. Anyway, the postage for writing letters was soon going to exceed my original subscription payment.

I subscribed again on August 4, 1980, at a cost of \$18. I received the September issue in late September, and shortly thereafter, I received my October issue. Two weeks later, I received the August issue. Of course, I had already purchased a copy from the hobby shop. At last, my problems were solved. It was obviously my fault because I had moved.

#### Wait!

No November issue. I wrote the subscription service. No reply, no magazine. Since I had to go to the hobby shop to buy some things, I bought a magazine and wrote it off to experience. Needless to say, I became irritated.



No December issue. I find that my local Radio Shack dealer is now carrying 80 Micro so I buy my issue there. Now I only have to pay the retail price for the magazine and travel three miles. I gave my problem some deep thought and decided that I would just continue to purchase from the local store and forget subscription service. The retail price is high but it is still cheaper than the subscription service!

Alas, my good fortune was limited. Due to the small demand for the magazine as an off-the-shelf item, the store was going to discontinue it. It seems that other TRS-80 users locally were having no problems with the subscription service.

What do I do now? I can go back to driving 50 miles for my magazine or I can try the subscription route again.

I decided to try a subscription one more time. Of course, I'm becoming better educated on how to do business with mail order outfits, as I had also been stung in buying software by mail. Do *not* send money until after you receive the product!

I tore out one of the handy-dandy subscription postcards in the last issue of my store-bought magazine, filled it out, and marked it *bill me*.

Success at last!

I received the November 1981 issue. I received the December 1981 issue. Then I received another December issue. Then I got another December issue. This computer stuff was beginning to get to me.

Not to worry!

I figured it out! This was the third time I had subscribed, so now I was going to get three copies each month. Wow! I gave away the extra copies and relaxed. I should have known better.

The January 1982 issue came. Then the second and third issues came, just as I figured.

#### Wait!

I then got copy #4, and then #5. This is a madhouse situation!

I received my bill for the subscription in the mail. I had them now. After spending 30 years as a detective in law enforcement, I knew I could solve any mystery. I would include a letter with my check. That way, if they cashed my check, I would know that they received my letter.

I'm becoming quite crafty.

Success! In February, the multiple issues stopped. In fact, everything stopped. No nothing! I should have known!

Off to the computer store 50 miles away to buy the February issue.

No March issue. Of course, I didn't expect one. Off to the computer store again. At least, I get my merchandise before I pay my money.

What do I do now?

Write another letter. Waste of time. Obviously, there is no actual person at the subscription service address—only a computer. That thought begins to bother me. Is it possible that there is no one at 80 Micro?

My fellow employees are beginning to stare at me and ask about my health. They can't understand why I'm taking so long to complete my magazine fraud case, on which I have been working for over a year. I've been known to solve megabuck fraud cases in less time.

Six-figure crimes take only three to six months. The old man is slipping, probably be going out on disability pension soon; mumbles to himself about magazines, computers, no humans existing in New Hampshire.

Off to the computer store for the April 1982 issue when I learn everyone in town already has received theirs. Soon I must find a reasonable story to tell my wife, as she is also looking at me strangely. She cannot understand why a grown man would drive to a store to buy a magazine when everyone knows that you can subscribe by mail. I just hope she doesn't find out that the store is 50 miles away and that I also subscribe to the same magazine.

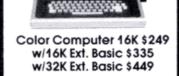
Before I've found an appropriate story to tell my wife, my April issue arrives in the mail. My wife asks why I received a copy in the mail when I had already bought that month's issue.

Today, I got the February issue. I can't believe this. I must be going insane. My wife is laughing hysterical-

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MODEL III 32K         856.50         R.S. Modem I D.C.         130           *MODEL III 32K         831.50         R.S. Modem II D.C.         210           MODEL III 48K         914         PRINTERS           *MODEL III 48K         864         Daisy Wheel II         1715           Model III 48K         DWP-410         1335           2 Disk & RS232 c         1899         Smith Corona TPI Daisy Wheel 599           Color Computer 16K         Epson MX80         599           Epson MX80 FT         549           Epson MX100         735           Color Computer 32K         CGP-115         199           W/extended basic         449         DMP-100         315           ‡Color Computer 32K-64K         DMP-200         599           W/extended basic         510         DMP-400         1029           Pocket Computer 2         230         DMP-500         1569
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Software.

ly. She thinks this is goofier than an Abbott and Costello movie. She asks a dumb question: Why do you have to buy *that* magazine when you already subscribe to five others with no trouble?

I ignore her, because I have a solution.

I will write a mystery novel. With this plot, I will become world-famous. I have found the perfect mystery that no one can solve.

With all the money I will earn, I can move to Peterborough, NH, and retire. If I look carefully, I can probably find an abode on Pine Street, and then I can walk down to 80 Micro each month and pick up my copy.

Henry A. Hoover P.O. Box 479 Elk Grove, CA 95624

Just kidding around, Henry. Heh heh.—Eds.

#### **Model I Interface Worries Over**

I am writing in response to a letter in the June/July issue of 80 Micro entitled "Expansion Interface Worries." Tandy won't help, but Personal Micro Computers (475 Ellis St., Mountain View, CA 94043) can. The expansion interface created for the PMC, called the "Expander," can be used with the Model I. Tandy's expansion interface costs \$497, but PMC's is only \$415 and the case is neater.

David Heyman Conway, PA

#### **Crusade Commentary**

I would like to respond to Steven Gross' letter in 80 Input (September 1982, p. 26). Had Mr. Gross bought a Model I and been misled into buying a Line Printer VIII, he would understand our frustrations with Radio Shack. The LP VIII was designed for use with the Color Computer and its use with the Model I is severely limited—and it's not even "foreign" hardware.

Martin W. Whitehouse 339 N. Sellars Mills Road Burlington, NC 27215

#### **Auto-Writer Replaced**

Dan Robinson's broad review of word-processing products (September

1982) was a valuable and much-needed contribution.

A new enhanced system (Data-Writer) has replaced the Auto-Writer program reviewed by Mr. Robinson. Mr. Robinson mentions Auto-Writer's selection, form letter, and report-generating capabilities. Now with its own data-entry program, text editor, file manager, double-precision math procedures, two-level sort, mailing-label program, and 4500-record capacity, Data-Writer has become a standalone data base manager, though it can also read files written with a word processor.

Written for the Models I and III, Data-Writer is priced at \$125. Further information is available from Software Options at 800-221-1624.

> J. R. White, President Software Options Inc. 19 Rector St. New York, NY 10006

#### No Losers

I disagree with Wayne's statement that "...about 100 years ago, Europe found that America was a great place to dump all of its losers..." ("80 Remarks," September 1982). Not so; while many Europeans wished they could come to America, only the most resourceful and brightest made it. Winners, not losers, arrived.

America's strength today is because of the industry of these people.

Harry J. Cozen 1285 Westwind Circle Westlake Village, CA 91361

#### Wayne's Wrong

Wayne Green's "80 Remarks" column (80 Micro, September 1982) attempts to undermine American technology and intelligence. The Japanese have only one edge over the Americans: money. Labor is cheaper in Japan and companies get grants from the Japanese government for research. Japan doesn't have to support a large military, so funds can be diverted to business.

There is no solid proof that the Japanese have an overall higher intelligence than Americans. Only one survey has been done in that field yet, which hardly makes it a fact. The Japanese who were tested were given Japanese versions of the American IQ test. Because of the language and culture difference, the Japanese may have had an unfair advantage.

Wayne also makes the observation that the Japanese are encouraged to take technical jobs through programs in high school while "most of our kids are spending their time on drugs, disco, and driving." That's a false statement (the Japanese people have a drug problem, too)—there are still a large number of competent and intelligent people who attend high school, college, and graduate school in this country.

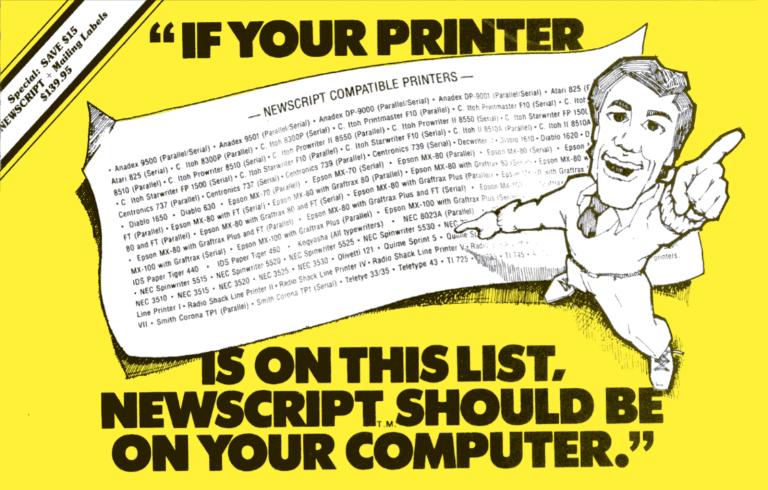
Wayne also thinks that CP/M is the "foot in the door" for the Japanese industry. No matter how extensively CP/M is used as a system, an industry such as computers is marked by rapid change. CP/M will never be the final operating system, and neither will anything else. The Japanese were ready to enter the microcomputer market with or without CP/M by 1980 anyway.

The success of the Japanese microcomputers will have to be seen. While they do produce silicon chips successfully, this is no indication of their success with computers. They have little or no software support, their user-friendliness is in doubt, and they enter the American market at a time when many people are saying, "Maybe we should buy American."

If the Japanese have such an edge on the Americans, why do they feel it necessary to steal company secrets from American companies? No, Wayne, American technology is alive and well. America invented transistors; America invented integrated circuits, and America invented video tubes. The Japanese appear very skilled at reconstruction, but have not invented many new products.

Wayne, what you wrote about the America of the past is utterly wrong. Americans are not hard workers any more than anyone else. If they are, it is not because of the minority Protestant work ethic or the "hard working spirit of the pioneers." Neither of these are significant enough to account for what you claim they do. The "losers" that came from Europe 100 years ago were not losers. They came to this country and found jobs, were productive, and contributed greatly. (Remember, Einstein was an immigrant.)

The bosh about success in America



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not being related to intelligence is just that—bosh.

Wayne also states (in reference to America) that "big business, with the blessing of big government, takes over every successful entrepreneur." That system is precisely what gives the Japanese their edge. The Japanese government funds the large Japanese companies in a situation where government, business, and people benefit.

Remember, Wayne, American society and the computer field are much alike. Both are diversified, and standards never succeed. The CP/M operating system might be valuable for a few more years. The computer field changes so fast, I plan to save my old Model I and sell it to the Smithsonian in 10 more years.

Howard Ullman 3533 Amberacres Drive Apt. #108 E Cincinnati, OH 45237

#### They Did It Again

I just received my September issue of 80 Micro and was reading the editorial comments and reader letters. In your "80 Remarks" column you chide Tandy for their lies and deception.

Well, they did it to you again. On page 24 of the September issue is a section entitled "A Pat on the Back For Radio Shack." The first letter describes the superior performance of Radio Shack and Tandy Corp. What the letter does not state is that the author, John Von Tobel, was, during the time in question, an employee of Radio Shack. As an employee, he of course would have received the royal redcarpet treatment. Considering that his most recent assignment with Radio Shack placed him in a regular Radio Shack store right next door to our local Computer Center and repair facility couldn't have hurt.

Radio Shack has turned out some fine products (I am the proud owner of a heavily modified early 1978 Model I, that I would not trade for anything). However, when Radio Shack runs ads like they did when they turned over almost their entire Computer Center staff here, the light at the end of the tunnel may well be an oncoming train. Those ads were seeking "Bright, career-oriented sales people—no com-

puter experience required." My question is, "If I were a businessman, would I trust the implementation of a computer system to such people?"

Until Radio Shack lives up to their word, I fully expect other makers to nibble away at the twin Tandy towers until they topple.

Donald Stephens 1962 Pommel Ave. Las Vegas, NV 89119

#### **Extended Basic Tips**

Here are some tips for Extended Basic Color Computer users. If you renumber an extremely large program accidentally, never press reset to regain the original state. That act leaves you with a demolished program, and no way to revive it. Having wrong GOTOs or GOSUBs is a much better fate than a program full of havoc.

If you make a mistake in the edit mode, and want to change it back, you could edit it out, or you could press reset and find that the line is in its original state no matter what you did to it. An easier way is to press 'a' while still in the edit mode. This works the same as the other two, but is easier to perform. Remember, once you enter an edited line, you can't do anything about it.

> Carl Huben 6929 Lee Crest Drive W. Bloomfield, MI 48033

#### Rammer Fix

I made a few modifications to Mike Keller's "Rammer" (p. 296, August 1982).

The program now allows you to fire missiles with the up arrow key and you're provided with a shield for your ship that protects it from debris or collision three times. The shield appears and falls away when the ship is struck.

Line 20 checks to see if the Model III special characters are in effect and turns off the clock. Line 40 defines the missile trail (BT\$) and the shield (CS\$). In line 50 B\$ is the missile and S is the number of shields available. Lines 270 and 280 are the actual missile fire routines

Because I compressed the program (see Listing 1) and renumbered the

```
10 ' Rammer Aug82 pg.296 80Micro
20 CLS:PRINT@0,CHR$(192):IFPEEK(15360)=32PRINTCHR$(21):GOTO20ELSEC
LS: CMD"T": GOSUB200
30 CLEAR 200: DEFINTA-Z: R=195: P=0: KB=14400: LT=32: RT=64: HM=0: TR=226
40 BT$=CHR$(2):CS$=CHR$(176)+CHR$(32)+CHR$(176)+CHR$(26)+CHR$(24)
CHR$(24)+CHR$(24)+CHR$(149)+CHR$(195)+CHR$(170)+CHR$(26)+CHR$(24)+
CHR$(24)+CHR$(24)+CHR$(131)+CHR$(131)+CHR$(131)
50 M=0:H=0:X=0:RP=15968:N=63:LE=15938:RE=15996:CL$=CHR$(30):S=3:B$
=CHR$ (253)
60 ES$=CHR$(34)+CHR$(222)+CHR$(34)
70 CD$=":* *:
80 DEFUSR=32755
90 PRINT@960, CHR$(R); = 3
                                       Enemy Ships Hit:
                                                                      Enemy Ships
 Missed: "
100 PRINT@HM, CL$; : PRINT@1014, M;
110 P=RND(N)-1:IFP>60THEN120 ELSEPRINT@P,ES$;:M=M+1
120 POKERP, 32
130 X=USR(X)
140
    IFPEEK(KB) = RTANDRP < RETHENRP = RP+2: POKERP+63, TR
    IFPEEK (KB) = 8THENMP=RP: GOSUB270
160
     IFPEEK(KB) = LTANDRP>LETHENRP=RP-2: POKERP+65, TR
170
    IFPEEK(RP) = 320RPEEK(RP) = 2THENPOKERP, R: GOTO100
180 S=S-1:H=H+1:M=M-1:N=N+5:PRINT@RP-15425,CS$;:PRINT@985,H;:PRINT
@964.S:
190 IFS<0GOTO230 ELSE100
200 FORX=32755TO32766
     READY: POKEX, Y: NEXTX: RETURN
220 DATA17,191,63,33,127,63,1,128,3,237,184,201
230 CLS:FORE=ITO30:PRINTSTRING$(64,(160+E));:NEXT:CLS:PRINT@395,"Y
ou scored ";H;" hits out of a posible";M
240 PRINT@530,"Your Kill Ratio is";(H/M)*100;"%"
250 PRINT:INPUT"Care to play again ";Al$
250 PRINT:INPUT Care to play again ";Al$
260 IFALS="Y"ORALS="y"THENRUNELSECLS:END
2/0 IFPEEK(MP) = 320RPEEK(MP) = 2PRINT@MP-15360, B$; : POKEMP+64, 2: MP=MP-
64:IFMP<15360RETURNELSE270
                                   GOT0270
280 POKEMP+64,2:PRINT@MP-15362,CD$;:H=H+1:M=M-1:PRINT@985,H;:RETUR
```

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Feature packed: Dot Writer allows underlining each word or underlining words and blanks. You can even specify how many underlines you want. IT IS RESO POSSIBLE to mix fonts with the RLITERNRTE FONT command: as I have done here. Proportional printing even works with most of our special fonts, Finally, you can take full advantage of the power of your Epson printer!

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lines, it would probably be easier to type it in than to change the original.

Dan Clemens, Proprietor Dan's Computer Works Route 1 End Road Summerville, OR 97876

How popular is "MONEY DOS"? These four letters came in on the same day.—Eds.

Just a note to let you know how much I enjoy "MONEY DOS" by J.M. Keynes. His column is fascinating and profitable.

> Philip Raczka 10076 Belmeadow Drive Twinsburg, OH 44087

Since the first installment of "MONEY DOS" by J.M. Keynes I have been hooked by the clear, concise, readable text. I urge you to continue to carry "MONEY DOS" in the future.

Frank Westphal 310 E. Philadelphia St. SP. 162 Ontario, CA 91761

I enjoy your magazine but if it got down to the real nitty-gritty, I'd have to say "Keep the magazine and send me MONEY DOS."

> Ace Nace 7105 Turner Terrace Fort Worth, TX 76118

I am interested in investment programs and feel that "MONEY DOS" by J.M. Keynes has had several very interesting and informative topics during the last several months. Please add more business investment articles and programs in future issues.

James H. Ferris 3328 High Vista Dallas, TX 75234

#### **Bittersweet Coverage**

The editorial coverage on our Electric Pencil System (EPS-80) was bittersweet. The subhead that stated the trouble with a ROM-based word processor was that it could not be changed, did not have any qualifiers. Three points should be made in this regard.

• The Electric Pencil program is a

user-proven program that has withstood the test of time. There are newer, better programs, but none as easy to learn.

- Any ROM-based program can be replaced by another ROM-based program.
- Since the EPS-80 is also a microcomputer (Z80-based) with Basic built in, there are other word processor programs available to operate in this environment.

Our EPS-80 is an economical, easily learned, and highly flexible system for the person who needs word processing primarily and computing power secondarily.

The EPS-80 can be upgraded to a disk-based system when the user is ready for more compatibility. Also, commercially available (and user installable) kits provide for CP/M software compatibility.

R. R. Troxell Director, Product Management Personal Micro Computers Inc. 475 Ellis St. Mt. View, CA 94043

#### **Medical Software Support**

Philip Mills' ("Medical Opinion," August 1982) article on the Medical Office System by Windham Software is a bit too glowing. I purchased the MOS, and while I agree that it is a step in the right direction I disagree that all is well.

It's slow, and the procedure fee column would not accept a charge over \$999.99. When I called Windham to discuss this glitch, I was told that Dr. Hayes was not available. I called back and was told that he was gone for the day. I called again and was told that he was gone for the week. I then wrote a letter and now, two months later, am still waiting for a reply.

This contradicts the statement that "support is excellent."

Leon M. Morrison, M.D. #9 Medical Park Morehead City, NC 28557

#### Dr. Mills Replies

The Medical Office System was written by an internist and is more suitable for an internal medicine clinic. Dr. Morrison's clinic is surgically oriented and would find it less satisfactory.

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# So Far, So Good...



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The second second	The second secon		

It should also be pointed out that the program is brand-new. If Windham Software is responsive to physician feedback, in a few years they will be marketing a very satisfactory program. I suspect that they are experiencing the realities of software marketing and its growth pains, and have had to adjust to the time demands of selling software.

> Philip R. Mills, M.D. 3000 Halls Ferry Road Vicksburg, MS 39180

#### Windham Software Replies

We disagree that the system is slow; for a micro system, response time is extremely fast. It takes an average of two seconds to put any one of 3,750 patient records on the screen. We do not know of any other micro system that can beat

this timing.

The problem with fees higher than \$999.99 has been corrected. The system now accepts fees up to \$9999.99. We sincerely hope that inflation will not force us to increase the maximum fee amount for the next few years.

John R. Hayes, M.D. Windham Software Inc. 29/31 Ivanhill St. Willimantic, CT 06226

#### **Hidden Routines**

Here is another footnote to Hugo Jackson's fine article "Memory Size?" (80 Micro, April 1982). Burt Fenner noted that space for Z80 Assembly-language programs can be reserved in Basic remark statements as an alternative to storing them in string variables

(80 Input, August 1982, p. 16). Mr. Fenner pointed out that remarks are not visited by the Basic "garbage collector." Mr. Fenner also noted that once the Z80 codes have been POKEd into the remark statement, the POKE routine may be deleted along with any data statements.

There is a third advantage that Mr. Fenner may have overlooked: The Basic program, shortened by removal of data and POKE statements, with the Z80 program in its remark, can be CSAVEd and CLOADed, even edited and listed! The listing of the remark will appear strange, since the Z80 codes will often refer to control and special characters.

There is a slight penalty if any zero codes occur in the Z80 routine: CLOAD will end the remark at the first zero code in the Z80 program. The next-line pointer that uses the first two bytes of the remark in memory must be corrected. If the Z80 routine uses less than 100 bytes, then the correction value for the Model III is the length of the Z80 routine. Program Listing 2 illustrates this method.

Statement 2 reserves 30 bytes for Z80 codes (even though the example routine uses only 12 bytes). Statement 1 restores the next-line pointer for statement 2 as if the Z80 routine included a zero code. Statement 35 copies the data values into the remark, while statements 40–80 display a byte-by-byte map of statements 1 and 2. Statement 90 executes the example routine, which simply draws a white bar near the bottom of the screen.

After the program has been run at least once, it can be reduced as shown in Program Listing 3 and CSAVEd.

A tip of my hat to Burt Fenner for this sly way to conceal a Z80 routine in a Basic program!

> David B. Dillon Baederwood Lane Derwood, MD 20855

Program Listing 2

97 REM Long 280 programs can use a relative jump (JR) from the end of one REMark to the start of another.

1 POKE 17400,30 2 REM !END?>USING@w# 90 POKE 16526,254: POKE 16527,67: PRINT USR(0)

Program Listing 3

#### Eds. Speak Out

POKEing machine language into remark statements is a great idea, but in our opinion, if it has a zero, POKE it into a string, or high memory.

Listing 2 works for a Model III under cassette Basic. The author could

```
1 POKE 17400,30
2 REM 123456789012345678901234567890*
3 REM Above REMARK is 30-byte Z80 program buffer
6 REM Address 17400 in statement 1 is beginning of statement 2
in a Model III. Use 17144 for Model I.
7 REM Value 30 POKEd in statement 1 is, coincidentally, the length of the Z80 program area reserved in the REMARK of
       statement 2.
8 REM It the Z80 program contains no zero-codes, statement 1 is
       not needed. Reduce the FOR arguments in statement 35 by
       15, to 17391 and 17390+length, respectively. Also reduce the POKE value in statement 90 by 15, from 254 to 239. A 33,128, 63, 62,191, 6, 64,119, 35, 16,252,201
10 DATA 33,128, 63, 62,191,
20 REM Above is a 12-byte Z80 program that draws a white line
         near the bottom of the screen.
35 FOR J%=17406 TO 17417: READ I%: POKE J%, I%: NEXT J%
37 REM Statement 35 POKEs the DATA values into the REMARK.
40 J%=17385
50 I%=PEEK(J%)+256*PEEK(J%+1): K%=PEEK(J%+2)+256*PEEK(J%+3)
60 PRINT J%, K%, I%
70 FOR L%=J%+4 TO I%-1: PRINT L%; PEEK(L%),: NEXT L%
80 PRINT: PRINT: J%=I%: IF K%<2 GOTO 50
85 REM Statements 40-80 display a byte-by-byte map of state-
         ments 1 and 2. Statement 90 executes the Z80 program
        placed in the REMARK.
90 POKE 16526,254: POKE 16527,67: PRINT USR(0)
95 REM Type the program and RUN it once to load the REMARK.
        Then delete every line except 1, 2 and 90. Add other lines if you wish, then CSAVE. The 280 program will be recorded as statement 2, and will CLOAD.
96 REM If the Z80 program contains zero-codes, it will not LIST properly after a CLOAD until statement 1 has been
         executed, either from the keyboard or in a RUN.
```

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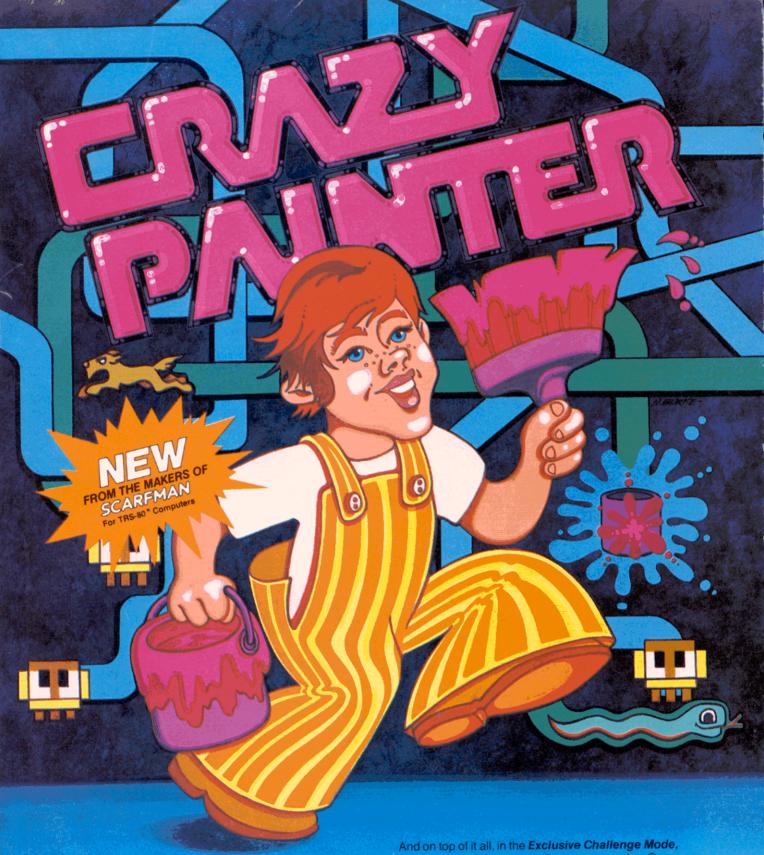
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-319

have used memory locations 16548 and 16549 to find the beginning of line 2. The following line will do it.

1 MA = PEEK(16548) + 256\*PEEK(16549): MA = PEEK(MA) + 256\*PEEK(MA + 1)NA = PEEK(MA) + 256\*PEEK(MA + 1):STOP

From the command mode, type:

?MA,NA,NA - MA

MA is the address of the first byte of line 2. NA is the address of the first byte of line 3. NA-MA is the number of bytes in line 2.

Now, for use at run time, change the stop statement in line 1 to:

NA = MA + nnnn: POKEMA.NA - INT(NA/256)\*256:POKEMA + 1,INT(NA/256)

Change the nnnnn to the value you got for NA-MA. Using this change ensures that the code you write will work for all systems.

Change line 35 to read:

FOR J% = MA + 6 TO MA + 17: READ 1%: POKE J%, 1%: NEXT J%

Change line 40 to:

J% = PEEK(16548) + 256\*PEEK(16549)

For cassette Basic change line 90 to:

MA = MA + 6:POKE 16526, MA -INT(MA/256)\*256:POKE16527,INT(MA/256)

For Disk Basic change line 90 to:

DEFUSR = MA + 6

-80 Micro technical staff

#### Straight, Not Flip-py Answers

I believe that all floppy disks are coated on both sides with the same magnetic medium, to reduce or eliminate warpage. You can punch two new read holes and a write-protect slot and make both sides of the disk usable. This modification makes the disk a flippy and it can be read and used on both sides.

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✓ See List of Advertisers on Page 451

read holes and one write-protect notch. or it contains two of each of the above, it's all done at one punching at zero additional cost.

Also, your magazine and most others fail to deal with the magnetic medium. There are variations in manufacture, quality control, and so on, and there are standards (ANSI or others) so let's have some articles on the basics and straight answers on the disk prices.

> R.M. Sanford 12787-139th St. N. Largo, FL 33540

#### My Savior

Thanks 80 Micro and "80 Remarks" for saving me just in the nick of time. I was all set to buy a TRS-80 Model II when I read in your fine magazine that the Model II is obsolete. I did go out and buy an Apple. It's a great machine.

> Harry J. Standish 5216 NE Sandy Blvd. Portland, OR 97213

Do we detect a note of sarcasm?

−Eds.

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#### Truth in Advertising

Firms that advertise in 80 Micro and other publications should live up to their ads. In the July issue of 80 Micro a



Line 60060 of Kurt Leafstand's "QuickCalc" program (October 1982, p. 120) is the end of the listing; it does not continue.

Randy Hawkins was incorrectly given credit for the program "Enter The Dragon" in Proof Notes (August 1982). The credit should have gone to Brice Hadlock, We stand corrected.

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retailer advertises "we will not be undersold" and yet their prices are considerably higher for some hardware than other firms advertising the same equipment in the same issue of the magazine. When asked why they made such a statement they replied that it was an advertising come-on to get customers. I advise potential customers of any firm to price shop for equipment and services before buying.

Walter Steesy Interlaken, NY 14847

#### **UTERM Fix**

I really enjoy using Bob Hart's UTERM program (80 Micro, June/July 1982, p. 128). However, if you try to use this program and have an early keyboard, you may run into some problems.

My keyboard has the old ROMs and the famous "quick and dirty" audio fix from Radio Shack. My board contains the small XR2 mod to help the volume sensitivity problem using cassette tapes. This improvement will not allow anything above or below 500 baud to enter the computer.

Since UTERM uses the cassette port and is set for 300 baud, the program will transmit but not receive using Bob's software, the cassette port, and the Shack's mod. To overcome this deficiency, a small DPDT switch must be added to switch out the XR2 mod when using the UTERM program. It is surprising to note that Tandy sells Model I modem software that uses the cassette port, but their own equipment is not compatible when you are stuck with an old keyboard!

Anyone wishing to learn more about the switch installation may get a copy of the instructions by sending an SASE to me. It takes about 10 minutes total time to have UTERM running on your system.

> Richard C. Walter, Jr. 824 East Chestnut St. Lancaster, PA 17602

#### Two Finger Typer

I would like to point out Lazy Writer's ease of use for a handicapped person limited to the use of one hand. Just about all of Lazy Writer's commands, editing as well as print and directory commands, call for the entry of a single keystroke. Rarely are you required to use a control key at the same time, and when you do, the keys are well within range of two fingers.

Sidney Bloom 114-A West Church St. Frederick, MD 21701

#### **Easier Directory**

For Model III TRSDOS users, Basic's CMD"D:d" produces a directory listing that is often more convenient than DIR. The program below, DIREC/CMD, displays the directory just like Basic. This program uses the top fifteen bytes of memory and is written for a 48K Model III with TRSDOS. For a 32K machine (see Program Listing 4) change the addresses in lines 160 and 240.

Carl Anderson Wilmington, DE

```
DIREC/CMD
                                 FROM 'TRSDOS READY' TYPE:
                00120 ;
                                 DIREC :D
                00140
                                 WHERE D=DRIVE
                00150
                00160
                                           ØFFFØH
                                                    FOR 32K USE ØBFFØH
FFFØ
                                 ORG
                                           4419H
                00170 DSPDIR
                                 DEFL
                                                    ;DISPLAY DIRECTORY CALL
                                           402DH
                                                    ;TRSDOS READY ADDRESS
H+7H) ;GET 7TH BYTE
402D
                00180 JP2DOS
                                 DEFL
FFFØ 3A2C42
                                           A, (4225H+7H)
                00190
                                 LD
FFF3 DD217142 00200
                                           IX,4271H
                                                             ;THESE TWO LINES PUT A ;INTO 4271H FOR DSPDIR
FFF7 DD7700
                00210
                                 T.D
                                           (IX),A
                                                              ;DISPLAY DIRECTORY
;BACK TO TRSDOS
                00220
FFFA CD1944
                                 CALL
                                           DSPDIR
FFFD C32D40
                                 END
FFFØ
                00240
                                           ØFFFØH
                                                              FOR 32K USE ØBFFØH
00000 TOTAL ERRORS
```

Program Listing 4

# BREAKT

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#### **MONEY DOS Fix**

The programs in the September 1982 MONEY DOS column (p. 364) contained several small errors. Listing 1 was renumbered, correctly updating all GOTOs and GOSUBs but leaving references in remark statements unchanged. Listing 2 did not write an end-of-file marker on cassette files. Program Listings 1 and 2 correct these errors.

In addition, lines 470-530 of Program Listing 2 on page 374 were accidentally printed at the end of Program Listing 1 on page 372.

80 Micro regrets the errors.

#### **Screenplay Errors**

My article (Screenplay) in the September issue contains a couple of errors. On page 208, the third paragraph of How to Use Screenplay states, "If you want to write as though using a typewriter, press shift down arrow..."—it should read "...press shift, down arrow, left arrow..." as Table 2 correctly indicates.

The Loop function that flashes all 10 pages of text on the screen in a continuous loop for animation effect contains an error. Line 7000 should read:

FORP = 1TO10:GOSUB9100:GOSUB5800: GOSUB9800: IFS = 1THEN1200ELSENEXT: **GOTO7000** 

The end of line 1820 was omitted. It should include:

ELSEIFI>126THENI = I + J

170 REM DELETE 180 IF NO DISK

MAY DELETE.



Jim Stauble of Des Moines, IA has shown me another way to code lines 9900 and 9910.

9900 F = 0:FORR = 1TO1:F = NOTF:IFF = -1POKEV.IELSEPOKEV.PEEK(V+T) 9910 FORW = 1TOJ: I\$ = INKEY\$: R = -(I\$>""):IFRAND1RETURNELSENEXT:NEXT

This coding is shorter than the original but has no effect on the typing speed. Placing a subroutine immediately following the calling section can help the interpreter find the subroutine more quickly. Unfortunately, this subroutine is called by several sections of the program, so many references would have to be changed.

For those interested in this approach to editing and printing memory contents, a machine-language version of Screenplay is available. Called Coretext, it runs on disk or stringy, is tailored to the MX-80/Graftrax, has many more features, and is faster than the fastest typist. The cost is \$10 prepaid or \$5 if you provide disk or wafer and SASE. The same terms apply if you want me to send you a copy of Screenplay.

If you want to know what line 7000

does (the incorrect line 7000, that is), it copies all 10 pages of text memory into higher memory, starting at address 32768. It's used for transferring Screenplay text to the text memory area of disk Coretext.

> Warren Merkey 114 SE 1st St. Gainesville, FL 32601

#### **Bug Report**

To correct "Save Our Ship" (80 Micro, August 1982, p. 174) Model I users should change the value 65535 in line 29 of Listing 1 and line 20 of Listing 2 to 65536. Also add a new line to Listing 1:

31 FX = FX + 65535 \* (FX>32767)

Model III users should change the value 65535 in line 29 of both listings to 65536. Also add the same new line to the program as above.

> Randy Hawkins 6214 Hidden Cove Corpus Christi, TX 78412

#### **Pronouns vs. Prepositions**

The September 1982 issue of 80 Micro was great. Dan Robinson's comprehensive report was good except for a slip that he or your copy editor should have caught.

On page 123 of Mr. Robinson's review of Aspen Software's Grammatik program, he writes: "... and too many prepositions (especially I) may make the writer look like an egomaniac." A preposterous preposition if ever I've heard one! Don't you mean pronouns? How can a diddly little preposition (at, after, by, down, for, from, in, into, etc.) make a writer appear egomaniacal? Pronouns, especially the first-person singular pronoun (I), can indeed make a writer appear a little self-centered. However, the sample of Grammatik's text summary you cited in the article only lists prepositions; nowhere do we see a mention of pronouns. You computer guys do understand the distinction between a pronoun and a preposition, don't you?

Oops.—Eds.

Jeff Shear 46 Wiggins St. Princeton, NJ 08540

285 IF U\$="" THEN CLS:PRINT"I'M FINISHED": END

Program Listing 2

Program Listing 1

50 ENS="EOF" 280 IF U\$="" THEN IF SS=2 THEN PRINT#-1,EN\$

550 CMD"T": REM CHANGE THIS LINE TO 550 REM IF NO DISK. 590 REM 600-660 ARE FOR DISK USERS . TAPE ONLY USERS

1140 IFD\$="SUGAR"THEN E1=4: E2=10: E3=23: RETURN



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#### **Handicapped Handicap**

If a golfer claims a handicap of eight it might be assumed that he is pretty good—unless it turns out that this handicap was computed using Michael Avery's system ("Two Strokes a Side," 80 Micro, May 1982) instead of the official USGA system.

Any golf league, association, or club is free to use any system for assigning handicaps, just as it can adopt any set of rules for the play of the game. Scores and handicaps obtained under modified rules cannot legitimately be compared with those acquired with the standard rules. Articles such as Mr. Avery's reinforce the mistaken idea that handicaps are simply numbers assigned arbitrarily, with poor golfers getting big handicaps and good golfers low handicaps. USGA rules regarding handicaps are explicit, and differ drastically from Mr. Avery's rules and from those he describes as the USGA system.

The use of course par in place of course rating is simply not justified. Under the USGA system, a par 72 course can have a rating anywhere from 62.8 to 80.6. These are extremes—course ratings are generally two to five strokes less than par.

The look-up table that Mr. Avery uses (he gets the endpoints on the wrong side, does not reproduce the entire table, and overlooks the fact that SM might be equal to 358.8) is one that has not been used by the USGA since 1975. It is not true that this table includes the increased difficulty factors in lowering one's handicap as the handicap approaches zero; it was published for those who find the problem of taking 85 percent of a number and rounding to the nearest integer too mathematically demanding.

Avery's system differs from the USGA's in using the best five of the last 10 scores rather than the best 10 of the last 20, and in using nine hole scores instead of complete rounds.

It is not true that the USGA handicap system cannot be applied to those with fewer than five scores; while these handicaps are not official, they are computed and designated as temporary by adding the suffix T.

Mr. Avery asserts that his handicapping system "will do a credible job for a small golf league." If this is all that is desired, a much simpler system, not re"I developed this program as an aid to golf leagues...".

quiring a computer, could be devised.

A golfer's USGA handicap is defined as 96 percent of the average of the lowest 10 of his last 20 differentials, provided at least 20 scores have been reported. If M (the number of reported scores) is less than 20, then N, the number of differentials to be counted, is determined as follows: if  $M \le 5$ , then N = 1, if M = 6, then N = 2, and if M > 6, then N = M/2, rounded to the next lowest integer if M is odd. Details, together with the current look-up table, can be found in the USGA magazine Golf Journal (Nov./Dec. 1980, pp. 19-22).

While the USGA system is far from perfect, all clubs assigning handicaps to their members should use a uniform system. Inability to adapt the standard system to a small computer is a poor reason for changing the system.

B.J. Ball Rte. 3, Box 372 Watkinsville, GA 30677

#### Michael Avery Replies

I indicated in the article that a modified form of the USGA system was used. The method I developed does not differ drastically, as Mr. Ball states. I indicated that course par could be used in place of a course rating because many small courses don't have a course rating. Are these courses to be denied handicapping?

If Mr. Ball had checked the program he would see that the possibility of SM being greater than 358 is taken care of in line 1530.

When the program was written (about four years ago), it had the correct handicap look-up table. The new table can be found in the latest edition of the golf rules, section 6. In the same section, the statement "Fewer than 5 scores: no handicap" would seem to contradict Mr. Ball's statement.

The data storage routines I used were not very efficient. Using more efficient numeric string packing for cassette storage, as I now know, would greatly improve the storage perfor-

mance.

The rules I used for determining the number of differentials used are identical to the USGA method, but scaled down for a maximum of 10 scores of course.

I developed this program as an aid to golf leagues who wished a local handicap. No attempt was made to make this an official handicap, nor do I think it necessary. All that counts is that the calculation be fair and consistent. I believe that the program accomplishes that goal.

-Michael Avery

#### **Golf Fix**

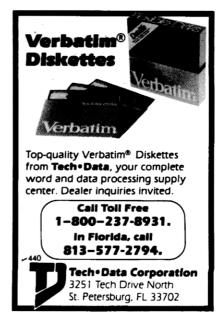
Helpful callers have identified a few errors in the coding of my "Callaway Golf Scoring Program" (80 Micro, May 1982, p. 300). The changes are as follows:

1220 L=0:L1 = 0:P1 = 0:IF SH<>1GOTO 1270 2380 PRINT X + Y,T\$(X + Y),T1(X + Y) 2400 X = X + 10:IF NP>X GOTO 2370

and delete line 2360.

To use the program with a disk system do not set the memory size, and delete lines 10-30 and 160-200. The screen print routine will not work, but if your DOS has such a feature you can use that instead.

Rodger Wells 1008 Kehoe Drive St. Charles, IL 60174



#### **Donations Needed**

Goodwill Industries is interested in acquiring computer equipment. We are particularly interested in Model I hardware and software. Our organization is a non-profitable, charitable corporation, and contributions are tax deductible.

If any reader is interested in making a donation to Goodwill, contact me for further information.

> Sidney L. Bloom President, Board of Directors Goodwill Industries 114-A West Church St. Frederick, MD 21701

#### **Need Programs**

I am putting together a book of business programs for students in business education courses at the local technical institute. The accounting and business education students at this point only need to run programs.

The technical institute has Model IIs and Model IIIs. We hope to set up a micro lab next year. I would appreciate any and all programs that your readers would send for student use.

David P. Senkpiel
Instructor, Business Education
Guilford Technical Institute
420 Manor Drive
High Point, NC 27260

#### Cheap Green Screen

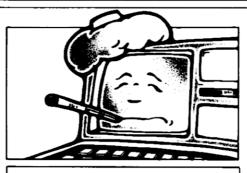
There are several green screens on the market, but being a penny-pincher, I came up with an idea that works very well.

I went to the local office supply store and bought a dark green and a light yellow punchless report cover. I put the yellow inside the green and attached them to my screen with scotch tape. This combination gives a nice green color, and costs only 50 cents.

> Richard A. Little 407-15th Ave. Sterling, IL 61081

#### For Sale

I have a new Quick Printer I for sale. It comes with the instruction manual and two rolls of paper. I am asking



\$300 or best offer.

Zacharias Beckman Pegasus Computer Systems 44040-6th Ave. Paw Paw, MI 49079

#### **More Music**

Has anyone written a program similar to Radio Shack's Micro Music? I'm looking for a larger text buffer. I would like the program to include: starting at a specified point, notes shorter than eighths, an additional two octaves (one higher, one lower), and a softer "N" atural command that returns specified options (speed, tone, octave) to normal.

I don't want to integrate with Basic

programs; this is for personal enjoyment.

D. Griffith 2932½ W. Knights Ave. Tampa, FL 33611

Jake Commander recommends Orchestra 80 from Software Affair. —Eds.

#### **Need Wiring Diagram**

Does anyone have the address of McClain and Associates Inc., Indianapolis, IN? They made and sold an interface called Selcon V and converted IBM 1980s to use on a TRS-80 Model I. They used to advertise in 80 Micro.

I bought a unit and need a wiring diagram for the 40-pin connector that connects the IBM 1980 with the interface. Does anyone have a wiring diagram that tells what color wire goes to what pin on the connector?

I have written to them but the mail is returned and they don't have a phone listing in Indianapolis.

> Robert Hober RR #3, Box 125 Holiday Island, AR 72632

#### Parameters For ESF Wafers

Galaxy Invasion MEM (23200) Robot Attack MEM (18432) Eliminator MEM (18688) Meteor Mission Cosmic Fighter Super Nova Attack Force Lunar Lander Defense Command The Count or Adventure Sampler Penetrator (Main or Editor) Starfighter (Main or Trainer) Pinball (Acorn) Swamp War EDTASM Plus (Microsoft) Z Bug (Microsoft) TLDIS (Disassembler) COPSYS Interlude (Over 16K)

Australian Programs Ghost Hunter Killer Beetle Alien Cresta Centipede Attack

Gobbleman

#### START.LENGTH.ENTRY

@SAVE1,232%, 9472,32724 @SAVE1,18432,14336,32686 @SAVE1,18688,14080,20692 @SAVE1,17664,11777,17664 @SAVE1,21760,10753,26073 @SAVE1,24064, 8449,25491 @SAVE1,17152,13570,30453 @SAVE1,20352,12290,20352 @SAVE1,18569,14136,18750 @SAVE1,17152,14592,17232 @SAVE1,17408,15100,17408 @SAVE1,16918,15100,17116 @SAVE1,20480,12289,29696 @SAVE1,17152, 5500,17520 @SAVE1,17280,12035,17280 @SAVE1,17280, 6070,17280 @SAVE1,28672, 3351,28672 @SAVE1,16969, 1012,17129 @SAVE1,16640,16130,23040 @SAVE1,17408,13312,17408

@SAVE1,20992, 7925,21200 @SAVE1,20480, 6588,26868 @SAVE1,20992, 8501,23449 @SAVE1,20992, 4131,21476

Table 1

#### VisiCalc Templates?

Are there any VisiCalc user-developed programs for Investment Stock Analysis and Bond Interest Earnings, and so on? No doubt some experts have developed better programs than the average user and may not object to making them available.

I would appreciate any suggestions.

Robert B. Foster 4909 Nasa Road 1 Seabrook, TX 77586

See Desktop Computing for an explanation of VisiCalc and its uses.—Eds.

#### **ESF** Copies

This information will be beneficial to anyone with an Exatron Stringy Floppy. I've enclosed a list of parameters to copy many popular machinelanguage programs onto Stringy Floppy. This information is tested for use on the Model I, Level II TRS-80.

From the Ready prompt type system. From the \*? prompt type the file name (or first letter of the file name) of the machine-language program you're loading. After the program has loaded, the \*? prompt reappears. Type /12345 to initialize the Stringy Floppy and return you to Basic.

Now type @SAVE1, start, length, entry. Start is the starting address, length is the number of bytes to move, and entry is the entry point. (See Table 1 for the parameters.)

Please don't use this information to pirate other people's programs.

Gobbleman will crash as soon as you answer the 1 or 2 player question. After the crash the computer reboots. From the Ready prompt type system. From the \*? prompt type /17408. Gobbleman will run correctly.

A. Tito 103 Lauren St. Urangan, Queensland 4658 Australia

#### Missing Copy

I am writing to see if you can help me obtain a copy of the November 1981 issue of 80 Micro. When I wrote in January to ask the subscription department for my missing issue, I was told it was no longer available and my subscription was extended one month. I then thought perhaps you kept a certain number for back issues, so I ordered a back issue, but again the reply

was it was no longer available. Anything that you can do or suggest in obtaining the November 1981 issue would be greatly appreciated. I value each one of my 80 Micro issues highly, and I don't want to be one short of a complete collection.

Murray Jones P.O. Box 698 Campbell River, B.C. Canada V9W 6J3

The November 1981 issue is as rare as proverbial hen's teeth. As a matter of fact, even some of our editors don't have a copy. Is there a reader out there who can help Mr. Jones out?—Eds.

#### **Modem Search**

I am looking for a modem that can be set at 300 or 1200 baud, and software to enable me to download or upload to disk from CompuServe or The Source. I was told that it's cheaper to download at 1200 to disk than to download at 300 baud to my printer.

I own a Model III Level II, 48K, 2 disk drives and an Epson 80 FT printer.

Terry Rubin 2928 Rockingham Circle Orlando, FL 32808

See New Products, November 1982.
—Eds.

#### TRS-232 Newsletter?

I would like to contact users of the Small Systems Software TRS-232 interface for the Model I. Many users of this clever interface could benefit from a newsletter; in particular, I am interested in exchanging information on inserting the TRS-232's printing code into machine-language programs which print via the parallel or possibly RS-232 ports only.

Please contact me if interested, and let me know what programs you have converted to TRS-232 use.

Sidney L. Bloom 114-A West Church St. Frederick, MD 21701

#### Monitor or TV Screen?

I would like to purchase a color monitor that I can use with my Color Computer and with my next computer (whatever that is).

Does Amdek, NEC, Sanyo or one of

the other color monitor manufacturers have a model that doesn't use RGB that would be compatible with my Color Computer, or is further modification needed?

> Samuel Baker 2823 Baker St. San Francisco, CA 94123

#### More Memory?

I recently installed 32K worth of memory in my Model III (from 16K to 48K) with chips purchased from one of your advertisers (Computer Plus). Everything seems to function normally except that now the PEEK and POKE commands won't function at addresses greater than 32767, which is where my 16K ended! I can load and run programs into the new memory, the ?MEM command gives a 48K response, but PEEKing and POKEing into the new section gives me an OV error. I can't burn in the new chips and my warranty is quickly running out on them! Can anyone help?

Also, does anyone know a simple way to send special characters such as control codes to a printer using cassette Scripsit?

J. William McDonald 4206 Trio Lane, Apt. #3 Louisville, KY 40219

#### Mission Aid

Our missionary organization (associated with the US Center for World Mission, Pasadena) uses a donated Model I, 48K with tape drive. We bought the TC-8 operating system and an ET12 interface, linking the system to an IBM Electronic 50 typewriter. Our main use is word processing, but we use a general ledger program adapted from 80 Micro.

We want to manage our mailing list with the Radio Shack Cassette mail List, but there are problems. Anyone who has used the program knows it sorts very slowly. Has anyone successfully modified this program to speed up the sorting process for use with the TC-8 system? Finally, how can I get lowercase with the mail-list program?

If you can help or would like to contribute equipment or software, please write or call (213) 797-1937.

J. Gene Adkins, President Omega World Missions Inc. 1605 Elizabeth St. Pasadena, CA 91104



\* \* \* \*

Sea Dragon Adventure International Box 3435 Longwood, FL 32750 Model I or III \$29.95 disk

by Eric Maloney 80 Micro staff

When Sea Dragon made its debut here at 80 Micro, our Eliminator fans didn't like it, while everyone else did. This was curious, because at first blush the two games are similar. Both feature a horizontal scroll, and both involve destroying (or avoiding) objects rising from the bottom of the display. In fact, Sea Dragon looked like an Eliminator clone.

But it didn't take too many hours beneath the phosphor waves to realize that Sea Dragon has an aquatic rhythm that gives it an integrity of its own. It's as cool and casual as Eliminator is hot and furious, with enough of a kick to keep it challenging.

The object of Sea Dragon is to guide a submarine (presumably called the Sea Dragon, though the documentation isn't clear on this) through a series of underwater passages and destroy a nuclear reactor. During the trip (which covers 24 screens), you must blast or evade a variety of mines, stalactites, battleships, lasers, and enemy attack stations. You also must maintain your oxygen supply by surfacing occasionally, or risk total obliteration.

Each direct hit is worth from 50 to 500 points. The big banana, of course, is the reactor, which is worth 5,000 in the novice mode or 10,000 in the expert mode. Once you blow it away, you go back to the beginning, at a faster and more difficult pace.

Like most arcade games, Sea Dragon requires digital dexterity. You must learn how to move your ship over, under, and around the rising mines, when

to speed up or slow down, when to surface for air, when to run or shoot, and how to avoid getting snuffed by the enemy attack stations.

When you figure all that out, you get to tackle the tough part—doing it while maneuvering through the tunnels. Touching the walls means complete annihilation (what else?), and the tunnels sometimes seem to go on forever. Finding a place to surface is cause for raucous jubilation, enemy mines or no. (This is definitely not a game for claustrophobics.)

At first, your scores will be pitifully low, which is just as well, because you won't want anything but to get through the tunnels. When you're finally good enough where points count, AI offers you their familiar scoreboard, which lets you (if you use disks) save the top 10 scores. This feature is terrific in places (such as the 80 Micro office) where a number of people are using the same disk, and will extend its playtime considerably. The permanent scoreboard should be standard on any quality game, and other manufacturers would do well to follow AI's lead.

Despite Sea Dragon's many qualities, what sets it a notch above the pack is the organic nature in which it was designed. The authors conceived a scenario, and then gave it the unique contours and rhythms its contents suggested. Thus, while the pace would be excruciatingly slow in outer space, it is well-suited to Sea Dragon's underwater environment.

(The expert mode, on the other hand, is frenetic enough to give your heart fibrillations.)

Sea Dragon is another example of an emerging aesthetic in the computer game world. Software authors are beginning to realize that a game needs to be internally consistent to stand the test of repeated plays. It doesn't work to simply state in the documentation that a blip on the screen is a space ship or a tank or a submarine. The game must invite the player to participate, to feel the

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Our reviewers use a five-star rating system. One star represents the low end of this spectrum, while five stars represent the spectacular and high end of the spectrum.

action, to sense the flow. The world it creates must be complete and self-contained. This is possible only if the shape of the game supports and enhances its premise. Authors Wayne Westmoreland and Terry Gilman (Armored Patrol, Eliminator, and now Sea Dragon) are quickly developing a track record that shows they have the knack.

Sea Dragon's major drawback is the combination of keys it requires you to use. The back arrow decreases speed and the enter key fires missiles, and it's almost impossible to do both at the same time. Also, you use the up and down arrows to move vertically, and you won't find a position that lets you get to both comfortably. The result is that you'll often hit the wrong keys when you can least afford to.

All in all, Sea Dragon is worthy of the AI stamp. It's not as distinctive or original as AI's classic Armored Patrol, but it offers more than enough to be a welcome addition to most game libraries. It might even catch on with Eliminator fans.

#### \* \* \*

TRS-80 Assembly Language Subroutines William Barden, Jr. Prentice-Hall Englewood Cliffs, NJ 07632 \$18.95

by G. Michael Vose 80 Micro staff

ill Barden has become the guru of BTRS-80 Assembly-language programming. The many thousands of words he has written on this tricky subject have endeared him to a vast audience of programmers hungry for tips on technique. He has even mastered Assembly language for the TRS-80 Color Computer. And it appears that he's not done yet!

Evidence attesting to Barden's leadership pops up every day, most recently in a book called TRS-80 Assembly Language Subroutines. Inside, you'll find 65 subroutines, all written in Z80 Assembly language. They'll allow you to perform a multitude of difficult-toprogram functions with speed and ease. The book is a veritable fountain of useful routines.

But wait a minute. When was the last time you needed to implement a 16-by-16 multiply operation in Assembly language? Or an ASCII-to-binary conversion? How about a multiple-precision BCD add?

This is pretty heady stuff! It seems that most of these subroutines, because they are very specialized or complicated, are useful only if you're a fairly sophisticated programmer. This is not evident, though, when you casually leaf through the first several pages.

Barden's attempt to make the book appeal to as large an audience as possible is confusing. I felt as though I had taken the wrong road in an adventure. It is obvious that a great majority of the routines in the book would be useful only to the kind of person who needs to implement a random number generator in Assembly language, for example, not a beginner's task. Yet the first two chapters of the book are a halfhearted attempt at introducing newcomers to Assembly language, a most difficult subject.

The writing in these first two chapters also belies the fact that Barden has been has lost interest in this aspect of the subject. Nevertheless, he has thrown them in, apparently to justify selling this book to an audience of beginners as well as seasoned Assembly-language mavens.

In spite of this shortcoming, this is a useful book. Many of the subroutines are useful to the Basic programmer who wants to speed up graphics, dump graphics to a printer, perform some elementary animation (moving dots), or implement a time delay. Other routines will aid the Assembly-language programmer who hasn't vet figured out how to write a random number generator, how to read/write disk sectors or cassette records, or how to read RS-232 switches.

The best feature of the book is its format. Each subroutine is written in relocatable code, meaning it can be used anywhere in memory because it contains only relative memory addresses. Each routine is printed as an assembled source-code listing so that the routine can be entered into a machine with either an editor/assembler or a monitor like Debug. Plus, each routine is also listed as a Basic data statement so that the routine can be POKEd into memory from Basic. Barden and his editors have even computed and listed the checksum for each routine so that the programmer can verify his data entry.

The book is spiral bound so that it lies flat on your lap or desktop while you're typing in the code for a routine. There is an appendix summarizing the Z80 instruction set so that making changes to specific routines will be easy for the experienced programmer.

Barden offers all the routines in the book on disk—the cost will be disclosed to you if you express an interest by writing to him.

There is no question that books like this one have a place in the library of information that is now available for the TRS-80. Anything that makes programming the computer easier is appreciated. It seems that Bill Barden will evermore be ready to fill that need.

Wolfbug 64K Color Computer Upgrade **Atomic City Electronics** 3195 Arizona Ave. Los Alamos, NM 87544 Wolfbug with adapter card \$55 64K RAM card without memory \$44.95 64K RAM card with memory \$144.95

#### by David L. Wasler

Tpgrading your 4K, 16K, or 32K Color Computer to 64K is a relatively easy modification when using Atomic City Electronics' 64K upgrade. The upgrade consists of two major components: a monitor called Wolfbug, which has 12 single-key commands, and a 64K RAM adapter card that reconfigures the old RAM socket

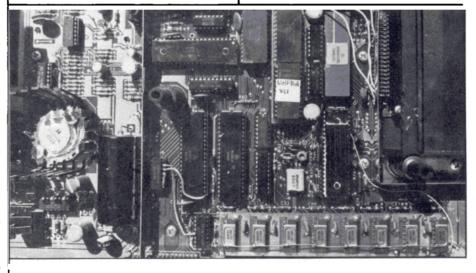


Photo 1. Top view of the Color Computer. To the left is U29 and U11 with the jumper. Bottom over this ground so many times that he | center is the 64K RAM card with 4164 RAM. Top center is the Wolfbug adapter card.

#### ARCADE EXCELLENCE



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But don't take our word for it. See the review in the August, 1982 issue of '80 Microcomputing. And remember, Med Systems offers to refund your money if you aren't satisfied. Just return the game within 14 days of receipt.

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Star Trap	Cassette	\$15.95 \$18.95

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J 83

to accept the new 4164 RAM. The uniqueness of this upgrade is its simplicity. Traces do not need to be cut: just solder in a couple of wires for power, address lines, and some jumpers, and you have 64K of usable RAM.

The instructions, which are very thorough, consist of two parts. One is for the EPROM adapter card, which holds Wolfbug in a 2716 EPROM. and the other is for the 64K RAM adapter card.

#### Wolfbug Adapter Card

The instructions for the Wolfbug card tell vou to remove the Basic ROM and install the new card. Be careful; Radio Shack sockets are the type that prefer flat pins, like the ones on an integrated circuit, and Atomic City's are the round-type pin. I filed the sides of the pins slightly flat to solve the problem.

Now, carefully push the Wolfbug adapter card. Care must be taken here to avoid damaging the adapter card or breaking the pins. If there is any resistance, check for a mismatch. Four wires must be soldered; one is to a ground wire while the other three are for decoding Wolfbug.

#### 64K RAM Adapter Card

Installing the 64K RAM adapter card is as simple as the Wolfbug card. Remove the old RAM, U20 through U27, from their sockets and install the 64K RAM card in their place. I experienced the same problem with the pins here as on the Wolfbug, so once again I filed the sides of the pins.

Another problem I encountered was that the RAM sockets, which Radio Shack installed, were misaligned, so care was needed when pushing the RAM card into place.

Two wires on the card require soldering: the wire on the left side of the RAM card to TP12 (+5 volt) and the right wire to V10, pin 35 (RASI). Two RAM size jumpers must be reconfigured, one by U4 to the 4K position, the other by U10 to the 16K position.

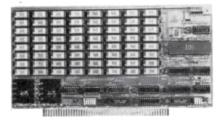
The Color Computer will run with these modifications now, but you cannot use the MAP type #1 mode yet. A iumper must be installed to get the MAP #1 (that is free memory from \$0000 to \$F800). For this part of the upgrade I recommend new U11 (74LS138) and U29 (74LS02) chips, because you can take out the MAP #1 mode, install the U11 and U29 chips and take your computer in for repair after, of course, you take out the RAM card and Wolfbug.

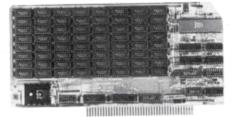
On the new U11, I bent pin 5 straight out; on U29, pins 11, 12, and 13, also. Next, I inserted the U11 and U29 into their proper sockets and soldered a jumper from U29 pin 13 to U11 pin 5, U29 pin 8 to U29 pin 11, and from U29 pin 12 to U8 pin 21. This completed my 64K upgrade. After double checking my work, I turned the power on and tested to see if I had the correct voltage on pins 1, 8, and 16.

The big step came next. After turning off the power, I carefully installed the new 4164 RAM, making sure all the pins were in their sockets. After turning the power on I requested the memory size. I got back 24871, which is correct for the Extended Basic computer. For owners of Standard Basic, it will be 31015.

Next I tried Wolfbug, which has a memory-test routine, by holding the break key, pushing and releasing the reset button, and answering R to the Wolfbug prompt. This switches the system to all-RAM mode (MAP type

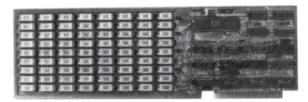
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board in the world) And you can put up to 8 megabytes in a system by adding more storage boards.

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#1), 64K only. After being prompted a second time, I entered T for memory test. I next answered \$0550 to the startaddress query and \$F7FF to the endaddress query (which is the end of free memory). Immediately, characters appeared on the screen and began to move, indicating that the memory was being tested. The memory test takes about 15 minutes.

#### What is Wolfbug?

Wolfbug is a machine-language monitor that resides at \$F800 to \$FFEA. Its 12 single-key commands are as follows:

• A is an ASCII dump of any memory location. When A is entered, you are prompted with a start address. After entering the address, a memory page appears (\$BF or 192 decimal memory address equals a page). An ASCII character will appear on the screen if a value at the required address equals an ASCII value. Hitting enter moves you to the next page.

- B enters Basic or returns you back to
- D routes the output to the display.
- F is the floppy disk boot.
- G is a go-to-a-machine-language program. After entering G, you are prompted with a Go-To query; enter your hex address and off you go.
- H is a hex dump of memory similar to A, except it gives you a hex value (a page here equals \$5F or 96 decimal). Hitting enter advances you to the next page.
- L transfers Basic to RAM in the 64K mode and runs it.
- M examines or changes memory. When entering M, you are prompted with an examine-address query. Enter

- a hex address. Hit the space bar to advance and the back-space key to move back.
- P sends everything out to the printer that appears on the screen.
- T tests memory. When entering you are prompted with a start-address query and then an end-address query. The memory-test routine checks RAM by writing a pattern and then reading it. This pattern is altered 256 times.
- R switches you to MAP #1 mode. which is the full 64K mode.
- X allows typing text to the screen, like a typewriter. If the P command is entered before the X command, hit the enter key and it will send the screen information to the printer.

Wolfbug is an excellent upgrade from its installation to fine documentation. I have been using it for six months and have had no problems.

Elementary Basic: Learning to Program Your Computer in Basic with Sherlock Holmes

Elementary Pascal: Learning to Program Your Computer in Pascal with Sherlock Holmes

Chronicled by John H. Watson Edited with Commentaries by Henry Ledgard and Andrew Singer Random House Inc. Vintage Books Division Softcover, 265 pp. each \$12.95 each

by John P. Mello Jr. 80 Micro staff

s the preface to these books goes, A Ledgard and Singer were taking a nip of tea one day when word came a trunk had arrived from England for Ledgard's wife Edwina. Neither man thought anything of the announcement until the next day when Singer noticed his friend was distraught.

"Henry, is something wrong? You don't seem yourself this morning," Singer said.

"It's the trunk," Ledgard replied. "Trunk?"

"The trunk that came for Edwina from England yesterday."

"Oh, that trunk. What about it?"

"It's a very strange trunk; that is, I mean its contents are strange. The trunk is full of manuscripts."

"What's so strange about that?"

"They all seem to have been written

"Watson opens each chapter describing an encounter with Holmes and his Analytical Engine."

by a certain Dr. John Watson about a certain Mr. Sherlock Holmes.'

"Now really, Henry, be serious."

"I am completely serious, but I haven't told you the best part of it. What do you suppose the manuscripts are about?"

"I refuse to have my leg pulled in this fashion, Henry!"

"Andrew, Holmes was an ace programmer. According to Watson, he used a successor to Babbage's Analytical Engine in his work. The manuscripts are Watson's chronicles of their experiences. Holmes's insights are brilliant. His deductive powers and methodical nature made him a natural programmer."

Even if apocryphal, Ledgard's and Singer's premise is intriguing. It is also entertaining because the authors take pains to capture the flavor and proper Victorian prose of the Holmes stories.

Watson opens each chapter describing an encounter with Holmes and his "Analytical Engine." Holmes uses the magical machine to solve a murder at the Metropolitan Club, unlock the mystery of a socialite's disappearance, identify cigars by their ashes, find a rare Bible, break up a burglary ring, create a cipher for the Foreign Office, add molecular weights, write coroner's reports, uncover the handiwork of his arch foe Moriarty, and write a treatise on his methods. Each problem is analyzed by the master of Baker Street, displayed first as an "algorithm"-a shorthand form of the program—then as an actual program.

At the end of each chronicle, there is a didactic commentary by the authors detailing the concepts used by Holmes to solve a problem. As you might expect, the commentaries lack the stylistic charm of the chronicles, but are invaluable in giving a detailed explanation of Holmes's methods. They also serve as counterweights making the books easier to read. When Watson showed signs of information overload ("Enough, Holmes! I can absorb no more."), Holmes usually suggests a diversion, a

#### REVIEWS

night at the opera or a cold partridge and a bottle of Montrachet. The commentaries act like such a diversion for the reader.

One disappointing feature of the books is the chronicles in them are almost identical, so if you read one of the books, the second one's ruined. After all, without the chronicles, these are just books on programming. However, reading the books together can give you some insights into how Pascal stacks up against Basic.

Another problem a novice might encounter is getting the Basic programs to

"...the commentaries lack the stylistic charm of the chronicles, but are invaluable in giving a detailed explanation of Holmes' methods."

work. The authors spend a lot of ink explaining the idea behind "pretty-writing"—properly spacing the elements of a program to make it easy to read and understand—but ignore "user friendliness." For example, in the program for enciphering messages, you are told "enter message characters." I put in the entire message only to have the program bomb—only one letter could be enciphered at a time.

Can you start with zero knowledge about these programming languages and become proficient in them from reading these books? No. I had some background in Basic and none in Pascal when I started reading the books. I found my Basic knowledge necessary to handle the later chapters in the Basic book. After reading the Pascal book, I still did not feel proficient in the language.

So without prior knowledge of one of these languages, you could find these books—despite their clever approach to the subject—heavy sledding. Before you pick them up, you should have been puttering in the languages for awhile or taken a short course in the fundamentals, preferably the latter. There is no substitute for thinking when it comes to programming, Ledgard and Singer noted in their books. The same may be true of classroom teaching.

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#### REVIEWS

Lisp Supersoft

\* \* \* \*

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\*\*\*

UOLISP Far West Systems and Software P.O. Box 3301 Eugene, OR 97403 \$109

#### by Bruce Powel Douglass

Lisp stands for list processor. Lisp is the language of choice in artificial-intelligence programming, because of its flexibility, power, and ability to work with symbolic expressions. The two Lisps reviewed here are good implementations of the language; they do, however, take different approaches.

#### Lisp

Supersoft's Lisp is not a "tiny" Lisp, but a complete version allowing full recursion. It has a PROG construct to allow using sequential types of programs written in Lisp. Lisp runs in 16K with cassette systems and supports single-precision, floating-point arithmetic and functions. It uses the Basic ROM routines to do this, which accounts for considerable reduction in the size of the Lisp interpreter.

The manual is fairly good. It is not a tutorial on Lisp, but does describe the Supersoft implementation well. It lacks an index, but does have a table of contents and a list of relevant references. It assumes little programming expertise on the part of the user other than a little familiarity with Lisp.

The language itself is easy to use. A Trace debugging facility is provided so you can trace a function's execution. Also, a symbolic-differentiation program is supplied, as well as a Taylorseries expansion program. These allow easy entry of mathematical expressions and generate the derivatives or Taylor series, respectively.

The package provides a few abilities beyond normal Lisp packages. The Basic transcendental functions (such as SIN, COS, ATN, and LOG) are supported. Explode and Implode, functions not supported by UOLISP, are supported. PEEK and POKE are also available in Supersoft Lisp, as is LPRINT. TRS-80 graphics commands are not supported.

Disk I/O is provided so that you can load or save functions and programs to or from disk. The files are saved in ASCII format, so you can edit them with a text editor. Generally, for long programs, it is easier to create and edit them with a text editor rather than using the Lisp environment. You can save property lists of atoms as well as functions and atoms. Tape users use CLOAD and CSAVE, and disk users use Load and Save; disk users can also kill disk files from within Lisp.

Edit, a Lisp editor, lets you modify existing Lisp functions. To use it, load it from disk (with the command (LOAD '(EDIT/LSP)) ) or from tape ((CLOAD)). You enter the editor with the command (EDIT FN), where FN is some existing Lisp function. You can add to the editor by using it to edit itself. Some of the abilities of the editor include moving across or down (into) a list, going to the top of the list, inserting text, replacing text, setting breakpoints, printing the entire function, and deleting an item. For simple editing, Edit works fine, but for extensive editing you should use a full-screen editor. Incidentally, you can use The Alternative Source's KBE for this purpose and have a full-screen editor within the Lisp environment.

Supersoft Lisp is an excellent Lisp for beginners and advanced programmers. It is easy to use, and many TRS-80 functions and floating-point routines are supported, adding to its flexibility.

#### **UOLISP**

UOLISP is not quite as complete an implementation as Supersoft's Lisp, but it has other attractions. UOLISP runs in a minimum of 16K, although 32K or 48K is recommended. The extras that come in the UOLISP package include a Lisp interpreter, a Lisp compiler, the Meta language writing system, an RLisp compiler, a Trace function, and a small Lisp editor. UOLISP does not support floating-point numbers.

The manual is not as easy to read as Supersoft's manual. If you are not an

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experienced Lisp user, it will be very difficult to get through. It does sport an index, but lacks a table of contents.

UOLISP supports a large subset of Lisp functions. It does not, however, support Explode, Implode, or Expand. TRS-80 graphics are supported.

Disk I/O supports the standard ASCII Lisp source-code format file, similar to that used by Supersoft and a Fast Load format since it contains a compiler in addition to the interpreter. This kind of file loads and saves more quickly, it takes up less space in memory and on disk, and executes significantly faster.

The compiler requires UOLISP to be resident to run the compiled programs and is easy to use.

LAP stands for Lisp Assembly program, and is a Z80 assembler resident with the interpreter. It allows you to enter Z80 op-codes (which are slightly different for this assembler than for the standard assembler since TDL mnemonics are used), and these codes will be assembled into a function. This is useful for creating functions that must run quickly.

One of the nice features about UOLISP is that it contains an RLISP parser. RLISP is a cortex syntax for

Lisp, and was created by A. C. Hearn in 1973. Lots of people are intimidated by the strange appearance of Lisp programs, and RLISP provides Lisp with a more understandable syntax. It contains a parser that reads in RLISP syntax and parses the expressions into Lisp format, and then passes it over to Lisp to evaluate. It is easy to move back and forth between RLISP and Lisp.

"Supersoft's Lisp is not a 'tiny' Lisp, but a complete version allowing full recursion."

RLISP is a structured language with If...Then, Do...While, and For constructs. The For construct lets you perform actions for each element in a list, as well as the standard FOR i := 1:2 DO. The syntax is FOR EACH i IN X DO..., where X is the list. RLISP functions can be compiled by the compiler as they are read in. The manual's chapter on RLISP is more readable

than most, and beginners should be able to get through it with a minimum of work. RLISP is a useful addition to this package.

Another addition to UOLISP is the Little Meta Translator Writing System, or Meta. It also sits on top of the Lisp interpreter. The intended use for Meta in the UOLISP package is for languagedesign experimentation. Meta supports BNF-like syntax, recursive-descent parsing schemes, lexical primitives, pattern-directed code generation, and syntax-error message generation. Examples are given, and a calculator-like language is implemented before your very eyes. If you've ever wanted a simple way to translate Fortran into Basic or Pascal into PL/C, this is the proper environment. A separate manual accompanies Meta. Lisp is the ideal language environment for writing such a translator. and UOLISP is greatly enhanced by including it.

UOLISP lacks floating point and a few Lisp functions, but is fairly complete and easy to use, once you figure out how. It also features a function compiler, the LAP assembler, RLISP, and the Meta Translator system. If you have experience in Lisp and like to experiment, UOLISP is a great choice.

 $\star\star\star\star$ 

Quest Aardvark-80 2352 S. Commerce Walled Lake, MI 48088 Color Computer, 16K \$14.95 cassette

by Beth Ann Norman

Quest is an adventure game written in Basic. Your goal is to travel through the lands of Alesia to Moorlock's citadel and, ultimately, defeat the forces of evil within. What makes Quest unique is that it's different every time you play it. It also makes good use of the Color Computer's graphics.

The game starts with the computer drawing a randomized map of Alesia. Certain features of the map are always the same; a river always runs straight across the middle of the screen, and Moorlock's citadel is always in the lower right corner. Also, two cities, one on

each side of the river, a mountain range, and a swamp are always present, although randomly placed. Your character is represented by a colon and is placed randomly at the beginning of each game somewhere in the upper half of the screen.

The bottom of the screen is the command line. Your major commands, with which you answer the "What now, Sire?" prompt, are: N, E, W, and S for the directions, M for redrawing the map, I for taking inventory of your possessions, and U for when you wish to use an item. There are other commands for special situations. For example, you might meet a band of well-armed ogres. The computer asks you if you want to attack, run, or be friendly. You reply by giving the first letter of your choice.

You start each adventure with 10 loyal companions. Your object is to gather the men, weapons, armor, and food capable of defeating the forces at the citadel. You gain men and money by fighting or coming to terms with bands of ogres, wizards, pilgrims, and

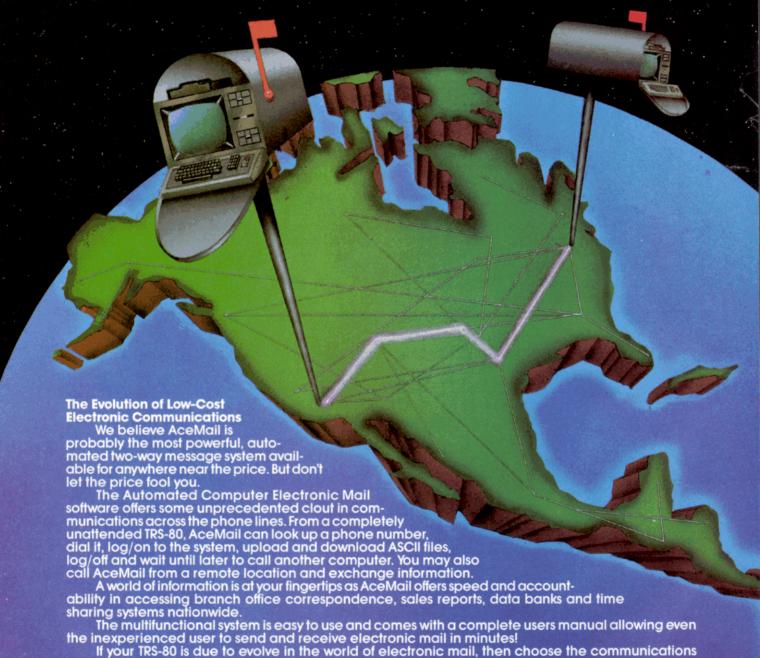
soldiers. You can also find money in caves, ruins, castles, and towers. All are randomly placed with each new game, and do not appear on the screen until you approach them while exploring Alesia. You can also buy food, armor, and weapons at the marketplace in each city.

You will need certain items to gain entrance to many places. For instance, when you find a cave, the computer draws a picture of the entrance and tells you, "You're at a cave. It's too dark to see! What now, Sire?" Your response might be to type in U for a listing of everything your men are carrying to see if you've brought a light source along. If you have, use it to enter the cave. You then are given the choice of searching or leaving.

I'll give you a hint: It you don't find anything at first, keep searching—you will find something eventually, even if it's a band of soldiers. If you re-enter a building after having removed the goods, though, you won't find anything new.

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marketplaces, you find that the list of what is on sale is randomized and changes with each visit. Some items have many uses, and there's one that I still haven't figured out. One of the funniest parts of the game is haggling with the merchants.

A realistic feature of the game is the weight system used. Each man can carry only 100 pounds. The computer keeps track of the total weight of your items (plate mail—50 pounds, broadsword— 10 pounds, and so on) and compares it to the amount your men can carry. If the total is too high, you must drop items until the weight is acceptable. You cannot ignore these warnings, since you will be unable to move until enough material has been left behind.

When you think you've found or bought everything you can in the upper half of the map, you're ready to cross the river. Beware traveler; your men can't swim!

Once you have crossed the river and you've gathered what you consider to be enough men, weapons, armor, and food, attack the citadel. You will find it difficult to defeat Moorlock's forces unless you have a certain item, which of course I cannot reveal. The display for a fight (either at the citadel or with any-

"Once you have crossed the river and you've gathered what you consider to be enough men, weapons, armor, and food, attack the citadel."

one you encounter) lists everchanging tallies of your men, weapons, experience level, luck, and survivors, against theirs. To stop the fight, hit the space bar when you think your luck number is higher than your opponent's, although this is just one factor in deciding the outcome. You can next see how many

survivors each party has. You can fight, run, or come to terms whenever a fight has been stopped. If you run, your foes may catch you, and just because you want to come to terms doesn't mean that they will.

If you kill all your enemies in a fight outside the citadel, salvage their equipment. If you come to terms, some will join you, bringing equipment, food, and money. If all your men are killed, of course, the game ends.

Quest is a wonderful, well-thoughtout game. It is a terrific game for beginning adventurers, because there are no sudden unreasonable ways to lose. For example, if you are losing men in a fight, you can always try running away. You can save a game on tape at any point (as long as the "What now, Sire?" prompt is on the screen), and return to it later. Quest is also fairly short for an adventure—playable in two to five hours. Since the game is different every time, you are not likely to lose interest in it the first time you defeat the forces of evil.

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LSI Soft-view CRT Langley-St. Clair Instrumentation Systems Inc. 132 West 24th St. New York, NY 10011 \$80-\$100

by Dave Smith

Remember the night you worked into the wee hours coding and debugging that super adventure on your TRS-80? Or the time you had to turn out that 30-page, end-of-the-year report with your word processor? Remember how tired your eyes became?

The reason for such fatigue stems from the cathode ray tube (CRT) Tandy uses in the manufacture of the TRS-80. It is basically a tv-type picture tube on which the display strobes 60 times per second. The screen is coated with rapid-decay white phosphors that fade quickly and are re-excited upon the next strobe, causing a repeated fading and

brightening. The LSI Soft-view CRT combats this problem.

These replacement CRTs are available with either a slow-decay green phosphor or a medium-decay amber (orange) phosphor. The medium-decay phosphors fade at a rate nearly 100 times slower than the white phosphors. For this review I used the amber display CRT.

The CRT comes with an eight-page installation instruction booklet. All the appropriate warnings regarding health, safety, and the invalidation of the Tandy warranty are prominently displayed in the booklet. There is also a handy list of the tools needed if you plan to do your own installation. (The alternative is to rely on your local computer center or tv repair shop for the installation.)

The instructions include fully detailed, step-by-step procedures, locations and types of screws to be encountered, colors of wires to be unplugged, and so on. They do not include any pictures or diagrams, but are very easy to follow just the same.

The hardest part of the installation is accepting the recommended one-hour wait following turning the power on before making further internal adjustments. (My installation required only one such adjustment.)

Finally, the moment of truth. It gave me a real lift to stand back and look at the familiar grey case with the totally unfamiliar amber letters and numbers on the screen. It took some time for my audiences' ooohing and aahing to subside, but I managed eventually to get down to some dispassionate assessment of performance.

The amber phosphors do not glow with the same intensity as the white. (I was later informed that they are only 42 percent as efficient in their light-emitting properties.) Therefore, I spent some time adjusting and readjusting the brightness and contrast controls for acceptable character clarity. In addition, the new CRT features both the double-dark leaded glass (standard) and the anti-glare surface (optional), further reducing the brightness of the screen. The

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#### CP/M for the TRS-80.

Converting to CP/M offers the TRS-80 owner many advantages. The TRS-80 immediately becomes capable of running twice the software of any other computer on the market. Perhaps more importantly, CP/M permits software portability. Unlike TRS-DOS programs, CP/M programs can be directly transferred to your next computer. The savings in time and software costs can be quite significant. CP/M conversion can easily pay for itself with the money saved on one or two software purchases. The sooner you convert to CP/M, the more you stand to save.

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#### Apple and Commodore Offer CP/M.

In a recent press conference, the Apple Computer Company stated, "The largest installed base CP/M system in the world today is the Apple II with the Z80 card from Microsoft." In a recent full page ad in the Wall Street Journal, Apple announced CP/M for the Apple III. Commodore, refusing to be left behind, has recently announced their "Emulator" series of computers that support CP/M. There are even rumors that the new Tandy I6 will support a version of CP/M.

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Products that set Precedents 1127 Hearst Street, Berkeley, CA 94702 (415) 845-8013 benefit of the leaded glass is the reduction of x-ray emissions from the screen.

My initial reaction was very favorable, but included a twinge of disappointment, since I had been expecting an amber duplication of the white phosphor screen. It was only after using the computer for an extended time that I fully appreciated the pleasure of fatigue-free viewing. I became accus-

"I became accustomed to the subdued amber screen very quickly."

tomed to the subdued amber screen very quickly, tending to be unconscious of the color and of the absence of flicker and glare until forced to use a standard machine. Having used the amber CRT, I found the black-and-white screen harsh and discomforting.

If you use your TRS-80 frequently or for extended periods at a single sitting, the improved viewing comfort and health features of these replacement CRTs are very much worth the price.

\*\*\*

FED File Editor for LDOS Galactic Software Inc. 11520 N. Port Washington Mequon, WI 53092 \$40 disk

by Charles P. Knight

FED is a file editor designed to run only under the LDOS operating system. It is a unique concept in zap programs in that it operates on the file level only, rather than the track/sector level. It is a great improvement over the usual zap program.

File level only does not mean that files like DIR/SYS and BOOT/SYS cannot be examined: they must be examined as a file rather than as a group of sectors. BOOT/SYS, for example, is a file of five sectors beginning at track 0, sector 0. If it is accessed as a file, it isn't necessary to know where it is on the disk. The password must be supplied. If you don't know it, RSOLTOFF gives you access to any file anywhere under LDOS. Because of this approach, many advanced features are available and you can perform functions that would be difficult if you had to know which sectors on the disk contained the file.

There are two display modes: One is a standard 256-byte mode with the ASCII display on the left instead of the usual right, and the other is an extended 128-byte mode with the ASCII across the top of the screen, the hex in the center, and plenty of space for other information (where the cursor is, name of file being worked on, hex and decimal value of byte under cursor, and so on).

Pressing the T key toggles between these two display modes. The latter is particularly nice for modifying ASCII files. Also available on the video in the 128-byte display mode are file name, relative byte under cursor, decimal and hex values of that byte, drive number, record number within the file, and the last command entered.

Graphics are not displayed and are represented by a graphic block instead of the usual period—a great help when dealing with files that contain both periods and graphics. I think a major improvement would be an optional graphics ASCII display, though. You can

"The usual file modifications are available plus much more. You can modify in hexidecimal or ASCII."

modify graphics by entering the appropriate hex character, but you can't view your changes directly by looking in the ASCII column.

The usual file modifications are available plus much more. You can modify in hexadecimal or ASCII, or if you want to know what the character under the cursor is in binary, press the equal key (=) and it is immediately displayed at the lower right of the screen. The binary representation should display the value under the cursor all the time in the 128-byte mode, as there is enough room on the screen; however, this is not a serious drawback.

If you want to know where a byte will load into memory, press M and the load address of that byte will be displayed. This is useful particularly when converting X-type patches to D type. If you want to save the modified file, you must press the break key to exit the modify

mode, and then press S followed by enter. By requiring that enter be pressed here, mistakes are more difficult to make and much easier to correct.

There are three commands for searching through the file (the whole file, not just the displayed sector like most zap utilities). The C command searches through the file for an ASCII string up to 15 bytes long in the 256-byte display mode or 30 bytes long in the 128-byte display mode. The search begins at the present cursor position and searches the rest of the file. Unlike many such features in other utilities, if the string searched for falls across sector boundaries, FED still finds it correctly.

The F command performs the above search for a string of hex bytes up to six characters long if in the 256-byte display mode, or up to 30 characters if in the 128-byte mode.

The L command, unlike any l've seen before, searches for a load address, and if found, positions the cursor over the byte that loads at that address. This search starts at the beginning of the file and continues until the end is reached.

The G command can be used after any one of the above three commands to go to the next occurrence of that byte, string, or load address in the file.

The D command prints the entire file to the line printer. If the printer is off-line, FED waits until it is ready or until the break key is pressed. The format prints three sectors of information on a page. FED performs its own pagination, so if you have a printer filter resident for output formatting, you might want to disable it to prevent conflict. The output is well formatted and thoughtfully arranged.

The P command sends the current edit buffer to the printer rather than the entire file, while the O command outputs a top-of-form character (CHR\$(12)) to the printer. This is a clear example of programming that

keeps the user in mind. Another example of this is the Enter command. Simply pressing the enter key displays a menu of available commands and their functions.

For machine-language programmers, the Z command jumps from load block to load block within the file. The cursor must be on the type byte (usually 01) when the key is pressed. FED then finds and positions the cursor over the type byte of the next load module. This is very handy for working out patches to someone else's code when you don't

have the source.

When you are done editing the file, you can press E and enter to exit FED, or N, enter, and the file name of another file to be worked on. During the entering of any command, if you change your mind or make a mistake, simply press the break key to abort the command sequence. To position the cursor to the beginning of the file or to its end, press the B or E key. To position the cursor at the beginning of a particular logical record (sector when LRL=256), press the R key followed

by the number of the logical record you want in hexadecimal. While editing, the arrow keys move the cursor and the semicolon and hyphen keys move the display forward or back one sector.

For \$40 you receive a disk-file editor that has capabilities you'll wonder how you got along without. I use mine almost daily and keep a copy on my working system disk so that it is always available to me. If you're an LDOS user and have a need to modify files at the disk-sector level, you should have this program in your library.

\* \* \* 1/2

Bounceoids Cornsoft Group Inc. 6008 N. Keystone Ave. Indianapolis, IN 46220 Model I or III \$15.95 cassette \$19.95 disk

by Mark E. Renne

The scenario for Bounceoids is a familiar one. You move your ship, located in the middle of the screen, by using a joystick or keyboard control. Your mission is to destroy the large, floating space boulders surrounding your ship before they destroy you. This game, however, is not another version of asteroids.

You can maneuver your ship in a variety of ways. The arrow keys, R, T, O, P, or a joystick can be used to turn the ship right or left, move it forward, or activate the shields. The shields protect the ship in the event a boulder gets too close.

Unlike an asteroid-type game, you cannot penetrate the boundaries of the screen. Boulders bounce off the walls of the screen and ricochet at 90-degree angles. Boulders form groups of four or more and move in unison. The groups can become very large at higher skill levels and form a straight line that crosses the entire screen.

If these groups of boulders aren't enough to throw you, a snake-like creature periodically appears from the side of the screen to confront you. In the higher levels, this multi-segmented creature becomes so long it is almost impossible to destroy.

If this still isn't enough trouble for

the advanced alien fighter, there's more action ahead. At points directly north, south, east, and west, alien artillery posts appear. When playing in the lower skill levels they will wait a long time before firing at your ship, but as you move up in skill, they fire very rapidly. Your epitaph will be written quickly if you're not fast on the fire button.

Just for fun, there's also a wandering alien who bounces around causing more problems for would-be starfleet heroes. With all these different bad guys running around, it's not easy to survive. Should you accumulate 10,000 points a new ship is awarded.

After 20,000 points you reach the real challenge of this arcade madness. A string of unique aliens descend from

the upper-left corner and move across the screen, allowing you to gather extra bonus points. At this point you also change skill levels.

Only the highest score is maintained on the system (and only until you turn off the power). You don't even get a chance to enter your initials. It does seem strange on a disk system that the top 10 scores aren't maintained.

Ten levels of play are available for one or two players. Each player may start at a different level of play. For example, player one may play at level 9 (expert) while player two plays at level 0 (beginner).

This game is fast and should provide the ardent arcader with enough action to provide a challenge and sore fingertips.

\*\*\*

The Disk Doctor Superior Graphic Software 406 Little Mountain Road Waynesville, NC 28786 Color Computer \$49.95

by John Steiner

The Disk Doctor is a Basic program that assists in the reconstruction of a damaged Color Computer disk file.

To ensure the integrity of your files, the Disk Doctor manual starts off with this advice: Check files for accuracy by using the Verify On command before saving a file or program. Use Field commands from Basic, rather than from within a program. Keep your fingers, coffee, nail files, and so on away from the head opening on your disks. Don't put disks on top of your monitor or drive unit. The magnetic fields generated by these devices make quick work of your files. Back up anything you think is important, and do it often.

Another hint given by the Disk Doctor is to put a write-protect tab on any disk any time you receive an I/O error. Write-protecting a disk keeps the allocation table from becoming garbled and assists you in the reconstruction of the disk. The disk files that are still intact can be transferred to another preformatted disk using the Copy command.

Regardless of what the Color Computer disk manual says, Copy will work on a single-drive system; just enter COPY "FILENAME/EXT". You are prompted when to change disks, just as

# Telewriter-64 the Color Computer Word Processor

- 3 display formats: 51/64/85 columns × 24 lines
- True lower case characters
- User-friendly full-screen editor
- Right justification
- Easy hyphenation
- Drives any printer
- Embedded format and control codes
- Runs in 16K, 32K, or 64K
- Menu-driven disk and cassette I/O
- No hardware modifications required

#### THE ORIGINAL

Simply stated, Telewriter is the most powerful word processor you can buy for the TRS-80 Color Computer. The original Telewriter has received rave reviews in every major Color Computer and TRS-80 magazine, as well as enthusiastic praise from thousands of satisfied owners. And rightly so.

The standard Color Computer display of 32 characters by 16 lines without lower case is simply inadequate for serious word processing. The checkerboard letters and tiny lines give you no feel for how your writing looks or reads. Telewriter gives the Color Computer a 51 column by 24 line screen display with true lower case characters. So a Telewriter screen looks like a printed page, with a good chunk of text on screen at one time. In fact, more on screen text than you'd get with Apple II, Atari, TI, Vic or TRS-80 Model III.

On top of that, the sophisticated Telewriter full-screen editor is so simple to use, it makes writing fun. With single-letter mnemonic commands, and menu-driven I/O and formatting, Telewriter surpasses all others for user friendliness and pure power.

Telewriter's chain printing feature means that the size of your text is never limited by the amount of memory you have, and Telewriter's advanced cassette handler gives you a powerful word processor without the major additional cost of a disk.

...one of the best programs for the Color Computer I have seen...

— Color Computer News, Jan. 1982

#### **TELEWRITER-64**

But now we've added more power to Telewriter. Not just bells and whistles, but major features that give you total control over your writing. We call this new supercharged version Telewriter-64. For two reasons.

#### 64K COMPATIBLE

Telewriter-64 runs fully in any Color Computer — 16K, 32K, or 64K, with or without Extended Basic, with disk or cassette or both. It automatically configures itself to take optimum advantage of all available memory. That means that when you upgrade your memory, the Telewriter-64 text buffer grows accordingly. In a 64K cassette based system, for example, you get about 40K of memory to store text. So you don't need disk or FLEX to put all your 64K to work immediately.

#### 64 COLUMNS (AND 85!)

Besides the original 51 column screen, Telewriter-64 now gives you 2 additional high-density displays:  $64 \times 24$  and  $85 \times 24!!$  Both high density modes provide all the standard Telewriter editing capabilities, and you can switch instantly to any of the 3 formats with a single control key command.

The  $51 \times 24$  display is clear and crisp on the screen. The two high density modes are more crowded and less easily readable, but they are perfect for showing you the exact layout of your printed page, all on the screen at one time. Compare this with cumbersome "windows" that show you only fragments at a time and don't even allow editing.

#### RIGHT JUSTIFICATION & HYPHENATION

One outstanding advantage of the full-width screen display is that you can now set the screen width to match the width of your printed page, so that "what you see is what you get." This makes exact alignment of columns possible and it makes hyphenation simple.

Since short lines are the reason for the large spaces often found in standard right justified text, and since hyphenation is the most effective way to eliminate short lines, Telewriter-64 can now promise you some of the best looking right justification you can get on the Color Computer.

#### FEATURES & SPECIFICATIONS:

Printing and formatting: Drives any printer (LPVII/VIII, DMP-100/200, Epson, Okidata, Centronics, NEC, C. Itoh, Smith-Corona, Terminet, etc).

Embedded control codes give full dynamic access to intelligent printer features like: underlining, subscript, superscript, variable font and type size, dotgraphics, etc.

Dynamic (embedded) format controls for: top, bottom, and left margins; line length, lines per page, line spacing, new page, change page numbering, conditional new page, enable/disable justification.

Menu-driven control of these parameters, as well as: pause at page bottom, page numbering, baud rate (so you can run your printer at top speed), and Epson font. "Typewriter" feature sends typed lines directly to your printer, and Direct mode sends control codes right from the keyboard. Special Epson driver simplifies use with MX-80.

Supports single and multi-line headers and automatic centering. Print or save all or any section of the text buffer. Chain print any number of files from cassette or disk.

File and I/O Features: ASCII format files — create and edit BASIC, Assembly, Pascal, and C programs, Smart Terminal files (for uploading or downloading), even text files from other word processors. Compatible with spelling checkers (like Spell 'n Fix).

Cassette verify command for sure saves. Cassette autoretry means you type a load command only once no matter where you are in the tape.

Read in, save, partial save, and append files with disk and/or cassette. For disk: print directory with free space to screen or printer, kill and rename files, set default drive. Easily customized to the number of drives in the system.

Editing features: Fast, full-screen editor with wordwrap, block copy, block move, block delete, line delete, global search and replace (or delete), wild card search, fast auto-repeat cursor, fast scrolling, cursor up, down, right, left, begin line, end line, top of text, bottom of text; page forward, page backward, align text, tabs, choice of buff or green background, complete error protection, line counter, word counter, space left, current file name, default drive in effect, set line length on screen.

Insert or delete text anywhere on the screen without changing "modes." This fast "free-form" editor provides maximum ease of use. Everything you do appears immediately on the screen in front of you. Commands require only a single key or a single key plus CLEAR.

...truly a state of the art word processor...
outstanding in every respect.

- The RAINBOW, Jan. 1982

#### PROFESSIONAL WORD PROCESSING

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Telewriter-64 costs \$49.95 on cassette, \$59.95 on disk, and comes complete with over 70 pages of well-written documentation. (The step-by-step tutorial will have your writing with Telewriter-64 in a matter of minutes.)

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Apple II is a trademark of Apple Computer, Inc.; Atari is a trademark of Atari, Inc.; TRS-80 is a trademark of Tandy Corp; MX-80 is a trademark of Epson America, Inc.

in the Backup command. Any Basic, ASCII, or binary file can be copied. Unlike Backup, programs in memory are not affected. You can use Copy from within a program, but you may have to switch disks often if the program is in memory or the file is large.

If you used the write-protect tab when you first received an I/O error. vou only need to reconstruct that file containing the error. The Disk Doctor reads the allocation table and displays the locations of the files on the disk. A single file is easy to locate from the table. Just make a copy of the table that contains file-continuation information. If you have a printer, the documentation tells you how to make the program print the table or any program output on your printer.

Once you have this information, you can check the contents of any sector on the disk. The Disk Doctor transfers the file to graphics memory one sector at a time. When the file transfer is complete. install a formatted disk, and the menudriven program transfers the file from graphics memory into a new disk file.

Reconstructing an entire disk involves a little more work, especially if the allocation table has been destroyed. The Disk Doctor lets you reconstruct any file type including machine-language programs.

The Doctor also contains a feature useful for good disks. If you locate the beginning of a binary file and read the first sector, you are given the start, end, and execute addresses. I recommend using the program on good binary files so you can find and store this informa-

"The author has included a crashed disk with your program disk. If you... reconstruct the crashed disk. you get a back-up of the Disk Doctor . . . "

tion should you ever need to reconstruct. Disk Doctor's written documentation

is minimal, but the eight pages are packed with information on reconstructing a crashed disk and preventative care.

The author has included a crashed disk with your program disk. If you successfully reconstruct the crashed

disk, you get a back-up of the Disk Doctor and a Packer program. Packer, a binary routine, removes excess spaces from any Basic program to make the program run faster. On the crashed disk, data and graphics files are included to demonstrate how they can be reconstructed. It takes very little time to learn the reconstruction process, if you do the assigned homework. The homework is an overview of the disk-allocation information in the Color Computer's disk operating manual.

I found one bug when I tried to transfer a large file. If the file you are transferring is larger than the eight graphic pages allocated (about 12K), the file must be recreated in parts. If you forget where you are and continue the transfer past the eighth page, you will overwrite the beginning of the Doctor and the program crashes. The only recovery is to reload the program and begin again. You will not encounter this bug very often (few files are longer than 12K) and a little care on your part easily avoids the problem.

The Disk Doctor teaches you disk anatomy as well as preventative medical information, allowing your disk files to lead long and fulfilling lives. I feel safer when creating important files and programs having the Doctor "on call."

\*\*\*\*

LCA-47 Lowercase Adapter Micro Technical Products Inc. 814 W. Keating Ave. Mesa, AZ 85202 \$25 additional character generator **ROMs** 

by Scott L. Norman

The Color Computer is maturing; we are beginning to see hardware addons similar to those introduced for the Model I. One such useful device that improves the appearance of text on the video screen is the LCA-47 Lowercase Adapter.

The LCA-47 is a small printed circuit board that plugs into the socket normally occupied by the Color Computer's MC6847 video display generator IC; the IC, in turn, plugs into the LCA-47.

In an unmodified Color Computer,

the 6847 uses its own circuitry to form and synchronize the video pulses that produce characters on the display. Lowercase letters are not included in the repertoire of this internal circuitry. When the LCA-47 is in place, the 6847 has access to an externally defined character set—in particular, one that is contained in a fast bipolar ROM. This set is then displayed by all programs that normally call upon the 6847 to perform its duties-the LCA-47 is invisible to such programs. However, Telewriter, Colorterm, and the like (packages that use the CC's high-resolution graphic modes to define new character sets) are unaffected, since they effectively bypass the 6847 anyway.

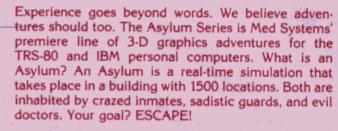
Installation of the LCA-47 requires that the Color Computer case and RF shield be opened, though, so all the usual precautions about the 90-day warranty apply.

There are only a couple of other things that should be mentioned. One is puter will have its 6847 soldered into the motherboard, rather than socketed. (This was the case with some of the early machines.) Recognizing the difficulties inherent in unsoldering a 40-pin IC. Micro Technical Products offers a refund to purchasers who meet this particular stumbling block; they also describe the procedure for sacrificing the IC and piggybacking the LCA-47 on the remains of the connecting pins. You must buy a new 6847 to make the computer operational, of course.

The only other problem likely to arise is mechanical interference with a particular electrolytic capacitor on the Revision E motherboards. There are actually two versions of the LCA-47 available: one has a clearance hole for this component.

Open the computer's case and RF shield before ordering. If the 6847 is soldered in place, you may want to rethink the whole affair; if not, check for a small tubular electrolytic mounted the possibility that your Color Com- | vertically behind the 6847. If it's there,

Words are not enough.



Our 3-D graphics are recognized throughout the industry for their machine-language speed and clarity. Hallways recede into the screen as though you are actually there. Doors open and close. Beds, desks, and other inmates are drawn on the screen. Instantaneously!

Asylums understand **complete sentences**, not just choppy one and two word commands. Sentences like "Drop everything on the desk except the matches" are interpreted and acted on **instantly**. Further, the command "VOCABULARY" will show you the entire dictionary, eliminating the need to second-guess program designers you have never met.

But don't take our word for it. See the reviews in '80 Microcomputing (Feb. 1981, Aug. 1981, May 1982). And remember, Med Systems offers to refund your money if you aren't satisfied. Just return the game within 14 days of receipt.

Although Asylum II is the sequel to Asylum I, you need not have played one to play the other. Asylum I and Asylum II require at least 16K of RAM, and are available on tape or disk (please specify). Hint sheets are available for each Asylum for \$1.00.

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The LCA-47's manual is excellent, and gives detailed instructions for removing the 6847 and installing the plugin board. The procedure isn't very difficult, but you should be cautious. Work slowly and carefully. When the board and IC are installed, you may find that one corner of the RF shield can no longer be pressed down as far as the others. I have never observed any increase in RF interference due to the misfit.

The LCA-47 board contains a pair of DIP switches, one to enable or disable the whole unit and another to reverse the foreground and background colors. The normal operation mode gives dark characters on a light background, which is very readable. If you prefer the reverse, just flip the switch. It is inconvenient to open the computer's case to operate the switches, so instructions are included for connecting outboard switches for remote operation. Once the unit is set up and enabled, the Color Computer's keyboard works in the usual fashion.

The LCA-47's output looks very fine indeed. Someone at Micro Technical Products has paid a lot of attention to the typographical aspects of the video display. You might expect that the lowercase characters would be good looking with real descenders, and so they are.

What comes as a pleasant surprise is the uppercase character set. A number of subtle and not-so-subtle changes have been made, with the result being improved readability over that of the Color Basic characters. For example, the letter O is now oval instead of rectangular: the numeral zero has a slash through it to avoid confusion. Uppercase letters S, E, and F, among others, have been improved, and even some of the numerals and other symbols have been touched up. My elderly tv receiver now has a much easier time resolving the asterisk; it no longer resembles a fuzzy plus sign.

#### Word Processing With the LCA-47

These changes improve the readability of both source listings and text output of Basic programs. However, the real value of the LCA-47 lies in word processing. Users of Color Scripsit, C.C. Writer, Super Color Writer,

and other color word-processing packages can now enjoy video output that looks like the printed page. This eases the chores of proofreading and editing.

The LCA-47 only solves the problem of character shape; line length and number of lines per screen are unchanged from whatever is standard for a given program. The appearance of printed characters is unchanged as well, although you can get an accurate reproduction of the video display with a screen-print routine. In fact, one of the pieces of literature included with the review copy of the LCA-47 was an electronic-circuit diagram produced on a Line Printer VII. The diagram included both uppercase and lowercase text and schematic symbols.

#### **Alternative Character Sets**

Since the LCA-47 uses a separate ROM to define the characters, anything that can be drawn within an appropriate area can be generated. The area within which the character must be defined is eight dots (video resolution elements) wide and 12 scan lines tall. At present you can purchase four character-generator ROMs from the manufacturer: the standard upper/lowercase furnished with the board, upper/lowercase with lowercase Greek letters, upper/lowercase with thinline graphics and electronic symbols, and uppercase with selected Japanese katakana characters.

In each case, the English letters are compatible with Basic programs, while the special symbols are accessed by POKEing appropriate values into the display RAM. A blank bipolar PROM is available if you want to do your own programming, and additional character sets are promised. Custom programming is also available.

#### In Summary

The LCA-47 is a well-made product that is supported by the manufacturer. The instruction manual is also of high quality.

It is interesting to speculate about possible enhancements. For example, I can imagine a larger board with at least two character generators, selectable by another DIP switch or from software.

For the present, the LCA-47 makes the Color Computer a more finished product, and deserves the consideration of all Color Computer users engaged in text processing.

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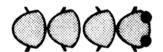
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\* \* \* \* 1/2

**Hypergate Centurion** 

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Hypergate Patrol Synergistic Solar Inc. Box 560595 Miami, FL 33156 16K Model I or III, cassette or disk \$39.95

by Mark E. Renne

Synergistic has developed two very sophisticated space simulations that require only 16K and yet are stimulating to even the best space cadets. They propel you into a universe filled with monsters, exploding asteroids, marauding pirates, and anxious allies.

The games, which are sold together, are related to each other. In Hypergate Patrol, you are the captain of a small patrol vessel wandering through the galaxy at the command of the Hypergate Centurion. In Hypergate Centurion, you control several Hypergate Patrol ships and a plasma weapon that spans the universe. The inhabitants of both games are identical, but the strategy is very different.

Hypergate Patrol is a program written in Basic with machine-language subroutines. Each galaxy is comprised of nine quadrants, and five galaxies make up your patrol universe. The galaxies are all joined in the center by a Hypergate. By entering the Hypergate at different angles, you can travel from one galaxy to another. For example, if you're in the Androm galaxy and receive a distress call from the Solan galaxy, enter the Hypergate at a 238 – 274 degree angle. Your destination will be Solan.

Your performance is rated on a merit-demerit system. Killing the bad guys rates five merits while killing a friend rates five demerits. You need a ratio of seven to one to survive. The game is played in real time and you must complete your mission within a specified amount of cycles.

Although the program is written mostly in Basic, it moves quickly and features 50 different aliens. At any given time a certain alliance will be the enemy of the guild and you must destroy any of that alliance's warships. Also, you must destroy pirates and monsters. Beware, though; pirates might be disguised as other ships and are only discovered by interrogation.

The video display is divided into

seven sections, providing all the vital information. Your ship features a variety of weapons, and a call to the Hypergate Centurion is always possible in a tight spot.

Hypergate Centurion is a machinelanguage, multi-level, space simulation of the highest degree. You are buried deep within an asteroid and control 15 quadrants of space. You have a fleet of five seekers in the hangar bay, ready to be dispatched with any of five different orders

As each object enters your jurisdictional area it is assigned a number. You can scan the area in four different ways—area, quadrant, tactical, or interrogation. This gives a variety of magnification and types of information depending on the scan.

Documentation for these two games consists of 45 pages of instructions in the form of an operations manual full of Centurion secrets. These are not arcade-type games, but simulations requiring skill, logic, and mental expertise. Even though they require only 16K, they are first class and offer a challenge that won't be mastered in one sitting.

\*\*\*

Date-O-Base Calendar
Custom Software Engineering
807 Minutemen Causeway
Cocoa Beach, FL 32931
Color Computer
\$19.95 disk
\$16.95 cassette

by Scott L. Norman

Leeping a calendar is a worthwhile task for any home or business computer. Date-O-Base is an inexpensive program that turns the Color Computer into an electronic datebook able to search and display short memos previously stored for a particular date. It also includes a calendar-page display mode that takes advantage of the Color Computer's high-resolution graphics capabilities.

Date-O-Base, or DOB, is available for cassette and disk systems; disks are best for the file handling this type of program requires. I reviewed disk DOB, intended for a 32K system with a single drive.

The program comes on tape, so your first task is to copy it onto a blank disk. There isn't much to this, since DOB is written in Basic: just CLOAD and save. When the program is first run, two ASCII files called MEMO/IND and MEMO/CAL are automatically created. These expand as the calendar fills with memos. A disk can hold more than 4.000 one-line memos of up to 28 characters each. There are restrictions, though: no more than 12 memos for any single day, no more than 300 for any month. This should be more than adequate for any household or small office. The program even allows multiple lines for complicated messages.

Although DOB's date-computation routine can handle any day of any month between the years 1700 and 2099, the program will probably be used for events in the near future. The input routines have been fine-tuned a bit; any year in the 20th century can be specified by giving its last two digits. Months can be specified by a number from 1-12 or by a three-letter abbreviation. The months, days, and years required as in-



put must be separated by commas.

When DOB is run (you have to enter the Run command twice when first starting a session), a master menu containing six options presents itself. This is home base; you can get back to it by hitting enter once or twice. Here are the details of operation:

• Option 0, End, must be used for all normal exits from DOB. Besides being used at the end of a session, you should select Option 0 after you have entered a series of memos that you will later want to search. It closes the disk files and carries out other housekeeping chores. It also terminates the program and returns Basic's OK prompt, so that an additional Run command is necessary to get back into action.

I found this to be the only tricky aspect of DOB's operation. I forgot to use Option 0 a few times, and wiped out some test files before I could check out the rest of the system.

• Option 1, Display Month, prompts you for a month and year, and then draws and numbers the appropriate calendar page using high-resolution graphics. You can enter memos for any day during the chosen month by typing in the date. The numbers you type will not show on the screen, but hitting enter causes the display to switch to a text screen that does show the date, together with 12 numbered lines for memos. You are then prompted for a memo number. When you have finished your entries, a null line (the enter key by itself) returns the calendar display. Now, however, the box for the date in question contains a reminder spot for each memo. When you have finished your month's entries, another null line gets the master menu back.

The data on any given page can be changed by overwriting. A memo can be deleted by specifying its number and entering a null line. This is fine for individual deletions, but there are easier methods for handling blocks of data.

It is possible to get a printout of the calendar display, but this requires an external screen-print routine—Radio Shack's, for instance, or one sold by Custom Software themselves.

• Option 2, Display/Change Memos, bypasses Option 1's calendar-drawing routine and saves some time. Option 2 lets you specify a date and jump right to the text screen. The entry, modification, and deletion of memos proceeds just as for Option 1.

"Date-O-Base...fills a genuine need at a reasonable price."

• Option 3, Search Memos, displays or prints memos falling within a specified period of time. You can read all the memos, or use keywords and search logic to restrict the output.

When you select Option 3, you are first prompted for start and finish dates for the search interval. Next, specify the search logic: AND, OR, or ALL. ALL bypasses the use of keywords and outputs everything found in the interval. Both AND and OR allow you to specify up to 10 keywords. The AND option only displays memos containing all of the keywords, while OR selects memos containing any one of them. If you are interested in only one keyword, either option will do.

• Option 4, Delete Memos, is a global delete function, eliminating all the data for a specified interval. The minimum interval is one month; both starting and finishing dates must be specified in MM/YY format, but you can specify the same month for both. DOB is a friendly program, and gives you a last chance by asking if you are sure before actually deleting memos.

Option 4 provides an alternative to the one-memo-at-a-time deletion capability of Options 1 and 2. You can also use Disk Basic's Kill command to eliminate the MEMO/IND and MEMO/CAL files. Of course, this wipes out everything but the original DOB program itself.

• Option 5, Date Computation, employs DOB's date-computation routine to compute the elapsed time between two specified dates. The output takes four forms: days, weeks/days, months/days, and years/months/days. There is one quirk: The first two display modes takes account of February 29 for leap years, while the last two do not (unless the elapsed time is less than one month).

Date-O-Base has quickly become a member of my Color Computer's assortment of household programs. It is easy to use (provided that you remember Option 0), and fills a genuine need at a reasonable price. If you can live with the short memos imposed by the program, it can do a good job for you.



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 $\star \star \star \frac{1}{2}$ 

Drive Control Unit Optronics Technology 2990 Atlantic Ave. Penfield, NY 14526 \$39.95, assembled \$29.95, kit

by David DuPuy

It has long bothered me that my eightinch disks continue to spin in the drive after I have accessed the files I need. The wear on the disk drive, and shortening the life of the floppy disk, seems unnecessary.

Now, eight-inch drive systems can be adapted to turn the drives off when they are not needed (see New Products, *Microcomputing*, May 1982, page 140). Optronics Technology's Drive Control Unit (DCU) is available assembled and tested, or in kit form. The DCU can be installed in existing eight-inch drive enclosures with a minimum of effort.

#### Concept and Features

I ordered the Drive Control Unit in kit form from Optronics. A six-page manual, with two pages of drawings and diagrams and a photograph showing how the unit mounts in the rear of an eight-inch Shugart drive comes with the kit.

The DCU's concept is simple. The 110 volts ac that is normally connected to the synchronous motor for rotating the disk is turned on or off by a triac mounted on the Optronics DCU board. A trigger signal from the Shugart PC board controls the triac, so the computer needs no extra wiring. The triac is opto-isolated from the logic, as you might expect. To minimize electrical switching noise, the ac voltage turns on or off at zero crossing. To turn a second drive on and off, Optronics provides a second control input and a second output. I could not test that option, since I have only one disk drive. After you access and release the drive (per normal operation before inserting the DCU in the ac line), the disk spins for about nine seconds after the LED goes out before shutting off. This nine-second interval can be changed when building the unit by changing one resistor.

#### Construction

The printed circuit board is about

2 3/8 by 3 1/2 inches in size and comes predrilled. There are about 20 parts to mount on the PC board. The instructions are adequate, and no one who has any experience at the Heathkit level should have any problems assembling the board. A drawing shows the placement of parts to be mounted, and I found no ambiguities in the instructions.

I do have a couple of suggestions for comments to be included in the next version. I saw no mention that parts mounted on the board should be bent parallel to the board (it is obvious that the triac should be bent over); the board layout is arranged so that the capacitors bend over to conserve vertical room, and the manual should mention this. Mechanical interference is possible between the molded nylon socket for ac input and the wires to the ac output socket. It would be simple to move the leads to the ac output socket 1/4 inch and avoid this problem. Also, the diagram showing hookup to the trigger signal on the Shugart PC board doesn't look like the PC board on my Shugart 801. Finally, although all necessary information has been included, the manual could use a little more organization.

The manual slants toward wiring that conforms either to Shugart or Siemens drives. If you have either of these, every detail you need to build and install this device is in the manual. The manual makes clear those changes that have to be made for different types of drives, and offers several options. A few extra components are included (signal diodes) in case you have a drive that requires slight wiring changes on the PC board.

Installing the PC board in the Shugart drive is easy. The molded nylon plugs included are identical to those used to connect 110 volts ac to the Shugart drive motor, and this PC board is inserted in series in the 110-volt ac line. The molded nylon plugs are mounted on the PC board so that the 110-volt leads support the board, and the cables in the drive need little rearrangement to accommodate the board. Five-volt and ground leads attach to the Shugart PC board, and the only other lead to connect is the trigger signal, which also goes to the Shugart PC board. For the Shugart drive, the manual instructs you to connect this lead to test point 11 (TP11) on the Shugart board. As I mentioned before, the diagram showing this connection does not resemble my Shugart 801 PC board. However, I located a pin marked 11, and that evidently was the right connection, since the unit works as advertised.

#### Performance

Upon installation in my system (with a CCS disk controller and Shugart 801 drive), the Drive Control Unit worked fine the first time without fine tuning or troubleshooting. The lack of drive noise and continual disk spinning is a delight!

I did experience a few problems. A disk-error message occasionally shows up when I first boot up my system, and typing B a second time (my monitor's command to boot from the disk) boots the system from the disk. The DCU manual recommends you lengthen the delay on the disk controller's HLD signal to about 360 ms. This did not solve the error message on boot-up, and I decided to leave the delay around 300 ms. This particular error might not show up on other systems. In the autoboot mode, this problem did not occur. although I had to press reset after turning on the machine while the disk was running to boot the system. The manual gives suggestions for troubleshooting in case other disk errors occur.

I have one problem that was probably not anticipated by the designers, and that is because I'm using only one disk drive. In copying from one disk to another using a single-disk, file-transfer program, problems occur if the nine seconds expires before changing the disks. The error message "Drive A Not Ready" appears. Nothing serious happens; you just have to reboot and try again. Switching disks within the ninesecond time limit is easy (you don't have to rush), and then the single-drive copy routine performs satisfactorily. You can lengthen the nine-second interval before turnoff if desired.

#### **Summary**

This product serves a needed function. The price is reasonable and the device works with no debugging. The disk-drive motor now shuts down nine seconds after being disengaged. Disk and drive wear has been greatly reduced. The unit mounts easily in the rear of a Shugart eight-inch drive without modification to the drive. You must solder three wires to the Shugart PC board to complete the installation. The instruction sheets are detailed enough to guide even a novice.













#### REVIEW DIGEST

*Understanding Computer Science*, Roger S. Walker, Tandy/Radio Shack, Catalog #62-1383, \$2.95.

"I picked up *Understanding Computer Science* while waiting in line at Radio Shack, and I couldn't put it down. . . . I'm convinced that it's a little-known treasure that belongs on any computer owner's bookshelf. This book is an inexpensive overview of all the major areas of computing, written at a level that any interested person can understand, and the information that it contains is perfectly packaged for home computerists." *Compute*, September, p. 100.

**Postman**, Soft Sector Marketing, Garden City, MI 48135, Model I or II, \$125, \$175 (form letter option), \$225 (hard-disk version).

"Postman fills a variety of small-business applications that require large mailing lists. It is written entirely in machine language and is menu-driven for simplicity. . . . There is only one way to describe the performance of Postman: 'Flawless!' "InfoWorld, September 20, p. 47.

Basic For Business, Douglas Hergert, Sybex Books, Berkeley, CA, \$12.95.

"Basic For Business is written for the businessperson who wants to know how and why a program works. It approaches the study of Basic from a businessperson's perspective; that is, it guides a reader through the development of several practical business programs, including a cost of goods sold inventory program, break-even point analysis, T-ledger accounts, depreciation, and basic statistical analysis programs." Personal Computing, October, p. 149.69.

Master Control, Soft Sector Marketing, Garden City, MI 48135, Color Computer, \$24.95.

"Alan Schwartz is to be congratulated on an innovative and highly useful program. It is written in machine language and from the first worked as the very brief, but adequate, instructions indicated. . . . The first few days living with Master Control the kids and I keyed in some programs. . . Master Control makes that task much easier and faster." Color Computer News, September, p. 29.

**Pro-80 Extended Basic**, Pro-80 Systems, Cedar Falls, IA, Model II and 16, \$195.

"Pro-80 Basic does what it claims it can do: It expands the capabilities of Radio Shack's Basic interpreter. Before you buy, you should be aware that some of the features contain potential hazards, and the sort is not as fast as some I've seen. However, my overall recommendation is that the package is worth its price." two/sixteen, July-August, p. 16.

Big Things from Little Computers: A Layperson's Guide to Personal Computers, Dale Peterson, Prentice-Hall Inc., Englewood Cliffs, NJ, \$12.95.

"Peterson discusses a variety of unique uses for personal computers in education, art, music and business, in the home, and by the physically handicapped. ... It is clear that Big Things From Little Computers is not a how-to book, but rather a resource book of better personal computing ideas and applications that can be implemented with a little effort and imagination." Personal Computing, September, p. 156.

MicroPilot, Tandy/Radio Shack, Model I and III, 32K disk format, \$79.95.

"The strengths of MicroPilot lie in its programming efficiency for educational/interactive programming. With MicroPilot you can ask a question, get an answer, evaluate the answer and appropriate feedback with three of four simple commands. ... The features that make MicroPilot shine are its edit/run capability, its graphics, its sound generation capability, and its record keeping commands." Creative Computing, October, p. 34.

The Tiny Compiler, Aardvark-80, Walled Lake, MI 48088, Color Computer, \$24.95.

"The name is appropriate because the Tiny Compiler does not pretend to be a sophisticated big-time compiler that will take whatever code you wish to write in Basic and generate machine-language instructions. Instead, and to the credit of Aardvark-80 which markets it, Tiny Compiler is billed as a limited compiler which, frankly, can speed up a lot of things that needed speeding up in the first place." *The Rainbow*, September, p. 89.

Stellar Escort, Big Five Software, Van Nuys, CA 91409, Model I and III, \$95.

"Your job is to protect the defenseless craft you are towing from the vile Cretonians who are out to destroy it. It is to your advantage to protect your craft well, because if it is destroyed the disruption of the force field immediately destroys your escort craft. . . . As compared to other games on the market in this price range, you will definitely get your money's worth from this one." 80 U.S., October, p. 102.

**RAM Slam**, DSL Computer Products, Dearborn, MI 48121, Color Computer, \$49.95.

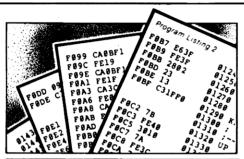
"At \$49.95 the RAM Slam upgrade kit from DSL Computer Products is one of the least expensive kits of the 'solderless' type I have seen advertised. ... Not being the technical type I was very pleased to see how easy it was to upgrade to 32K..." The Rainbow, September, p. 88.

Last December, I discussed bits and bytes. This month's column provides a short program that lets you examine the bits in the bytes of binary numbers.

The Assembly program takes advantage of a ROM routine. When the Basic interpreter encounters a USR function, it evaluates the function's argument. This sets the variable type flag at 40AFH and leaves the type in the A register. Therefore you need only access the A register to get the type, which also happens to be the number of bytes used to represent the number.

The type flag for an integer is two; for a single-precision number, four; and for a double-precision number, eight. If the binary number is an integer or a single-precision number, the bytes representing the number are stored starting at 4121H. A double-precision number is stored starting at 411DH. Table 1 summarizes this.

The Assembly code that displays the bits on the screen's top row is shown in Program Listing 1. These bits are displayed as ones if they are on, zeros if they are off. To determine the number of bits, multiply the type by eight. A double-precision number uses the entire top row of 64 spaces to display its bits. The bits are displayed with the least significant bit at print position 63 on the screen. The more significant bytes in a



#### Display bits from bytes

number are displayed to the left of the less significant bytes, the opposite of the way they are stored in memory. A byte of value 3 would be displayed as 00000011. Since the type flag is equal to the number of bytes in a number, the Assembly program uses it to set up a loop. This loop determines how many times to call the subroutine that displays the bits. A DJNZ loop structure accomplishes this. The HL register pair is ini-

tialized to the memory address where the argument of the USR function was placed after evaluation by Basic. The CP 8 in line 150 allows the adjustment for double-precision numbers to be made in line 170.

The DE register pair is used to point to the screen.

In line 190 the #-bits-to-display counter is saved by the PUSH BC. Line 200 loads a byte from the number. Next, a Call is made to the display bits subroutine. Here a bit mask is created in the C register by loading it with a one in line 280.

The mask works by ANDing it with the target byte stored in A. If the bit in the mask and the bit in the target byte are not on, the result is zero. Since the AND instruction destroys the value of the A register, the value is saved in the B register in line 290 and recovered each time it is needed in line 300. The load in line 320 does not alter the flags, so the jump in line 330 is still valid. The ASCII zero, or if the bit was on, the ASCII one is displayed on the screen.

Next, the screen pointer, DE, is backed up and the mask rotated left, which also performs a test for zero. This is a convenient way to exit the subroutine at line 390.

The Basic program (Program Listing 2) assumes you have loaded the machine code at address 7F00H. You will need to POKE the values for the USR address if you do not have Disk Basic. The program requests the type length in line 40 and validates the answer. Then a subroutine is called in line 50 to set the variable's type appropriately. This allows the program to easily change variable types.

The TYPE/2 + (TYPE = 8) expression in line 50 evaluates to a 1, 2, or 3 for integer, single-precision, or double-precision variables respectively. When (TYPE = 8) is false it is evaluated as zero; when true, it is evaluated as -1. Thus, 8/2 + (-1) equals 3. This works with almost all Basics. (Level I is not one of them.)

Line 60 requests the initial value of the number you wish analyzed. Line 70 requests the step value. If you want to examine just one number, answer with a zero.

Displaying double-precision numbers is impressive and demonstrates why processing them takes so long.

	00100	;BIT	DISPLAYER BY RO	OGER FULLER PUBLIC DOMAIN
	00110	;		
7F00	00120	ORG	7FØØH	
7FØØ 47	00130	LD	B,A	; SAVE NUMBER LENGTH
7FØ1 21214:		LD	HL,4121H	; POINT TO NUMBER STORAGE
7F04 FE08	00150	CP	8	; CHECK FOR DBL LENGTH
7F06 2002	00160	JR	NZ,\$+4	; IF NOT DBL THEN SKIP
7F08 2E1D	00170	LD	L,1DH	; ELSE BACKUP 4 BYTES
7FØA 113F30		LD	DE,3C3FH	; @63 ON VIDIO SCREEN
7FØD C5	00190 NUMBER	PUSH	BC	; SAVE LOOP COUNTER
7F0E 7E	00200	LD	A,(HL)	GET A BYTE
7FØF 23	00210	INC	HL	; POINT TO NEXT BYTE
7F10 CD1771		CALL	BYTE	;DISPLAY 8 BITS
7F13 C1	00230	POP	BC	RESTORE LOOP COUNTER
7F14 10F7	00240	DJNZ	NUMBER	;LOOP TILL DONE
7F16 C9	00250	RET		; DONE
1	00260	;		
	00270	;		
7F17 ØEØ1	00280 BYTE	LD	C,1	; MASK FOR BIT POSITIONS
7F19 47	00290	LD	B,A	;SAVE BYTE
7F1A 78	00300 BITOUT	LD	A,B	; RECOVER BYTE
7F1B A1	00310	AND	С	;TEST FOR BIT ON
7F1C 3E30	00320	LD	A,'0'	;LOAD A ASCII ZERO
7F1E 2801	00330	JR	z,\$+3	; IF BIT IS OFF
7F20 3C	00340	INC	A	; IF BIT ON MAKE '0' A 'l'
7F21 12	00350	LD	(DE),A	;DISPLAY '0' OR '1'
7F22 1B	00360	DEC	DE	POINT TO NEXT SPACE
7F23 CB21	00370	SLA	С	; MOVE MASK BIT LEFT ONE
7F25 20F3	00380	JR	NZ,BITOUT	; IF NOT DONE
7F27 C9	00390	RET		
	00400	;		
0000	00410	END		
00000 TOTAL	L ERRORS			

```
18 'BIT DISPLAYER BY ROGER FULLER PUBLIC DOMAIN
28 CLS: DEFUSR1=6H7F00
30 PRINT@128,"ENTER TYPE OF VARIABLE (2=INT, 4=SNG, OR 8=DBL)";
40 INPUT TYPE: IF TYPE<02 AND TYPE<04 AND TYPE<08 THEN 30
50 ON TYPE/2 + (TYPE=8) GOSUB 200, 400, 800
60 PRINT@256,"ENTER INITIAL VALUE"; INPUT NV
70 PRINT@384,"ENTER STEP SIZE"; INPUT NS
80 PRINT @ 512, "NUMBER = ";
90 PRINT@ 512, "NUMBER = ";
90 PRINT@ 500, USR1(NV);
180 NV = NV + NS : GOTO 90
200 DEFINT N : RETURN
400 DEFSNG N : RETURN
800 DEFDBL N : RETURN
```

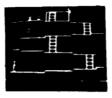
#### Program Listing 2

NMSB = 1 LSB = 1 EXP =	= Next Most Significant Byte Least Significant Byte Exponent Value Sign Bit		
310N =	INTEGER	SINGLE	DOUBLE
411D			LSB
411E	1		NMSB
411F			NMSB
4120			NMSB
4121	LSB	LSB	NMSB
4122	SIGN/MSB	NMSB	NMSB
4123		MSB	MSB
4124		SIGN/EXP	SIGN/EXP

Table 1

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MSB = Most Significant Byte

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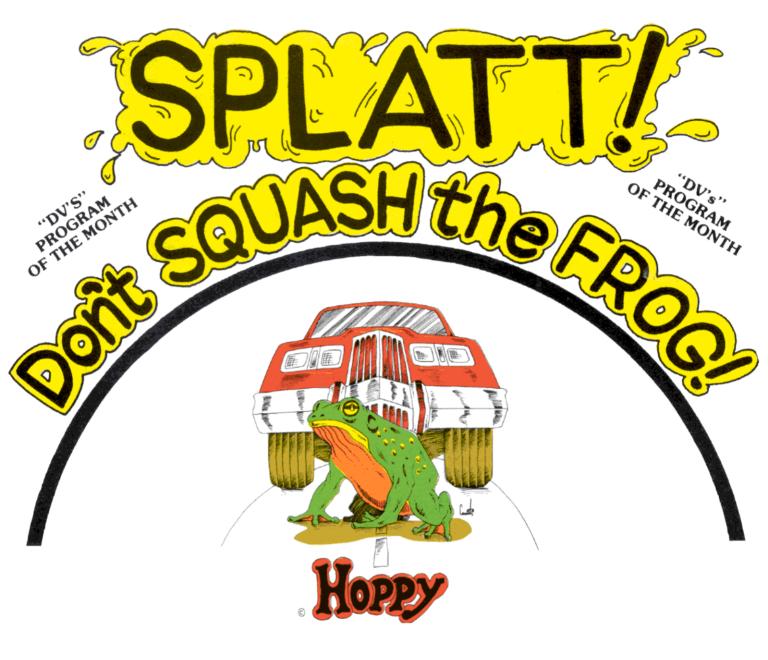
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THE SAD PLIGHT OF A FROG. HE FACES WILD DRIVERS AS HE TRIES TO CROSS THE ROAD. SINKING TURTLES, FLOATING LOGS AND HUNGRY ALLIGATORS STAND BETWEEN HIM AND HOME. HE NEEDS YOUR HELP!! ORDER SOON BEFORE ITS TOO LATE!!

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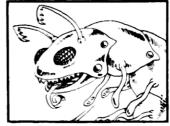


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ADD \$2.00 for Shipping. Add \$1.50 for COD. Michigan Res. Add 4 percent.

'TRS-80 Trademark of the Tandy Corporation

## **Extra!** Extra!



Insect Frenzy - Page 5

Volume 4

All The News That's Fit To ZAP!

# Users vote no to the same OLD ARCADE GAMES

















(DV 1982) Blurry eyed users have turned to DISPLAYED VIDEO to answer their need for new and exciting arcade games. In response, DISPLAYED VIDEO has announced eight new programs for the TRS-80\* Models I-III. These arcade type games feature sound, graphics, joystick compatibility and are written in machine language for maximum speed! Both disk and tape versions allow the user to save high scores, a feature not usually found on cassette based games. Maze enthusiasts seem to like Ghost Hunter and Killer

Beetles, while gun slingers look toward Insect Frenzy, Jungle Raiders, Space Shootout, Alien Cresta and Battle Stations for excitement. A Game that does not fall into these categories is Hoppy. It features wild drivers, sinking turtles, and hungry alligators. These programs are distributed exclusively by DISPLAYED VIDEO and written by Dubois and McNamara. Pricing for these programs is \$15.95 for tape and \$19.95 for disk. Reliable sources inside the company indicate Killer Gorilla will be available by the time you read this.

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**~62** 

# How long can you tread water?

We awoke to the dull staccato of rain beating on the van roof, as we had every morning during our stay in Eugene, OR. The doors had rusted shut overnight and Winthrop started screaming, "We're all gonna die, we're all gonna die," so I strapped him to his bean-bag chair and cranked up Hellfire Warrior on the Model I, and he quickly slipped back into his coma.

It was Winthrop's idea to come to Eugene because he'd heard that there were a lot of crunchy-granola types running around, and thought maybe we could find some New Age health freak who could figure out what was wrong with the PMC (which we affectionately call the Model ½) we'd found at the Goodwill in Pocatello, ID. I tried to tell him that foot reflexology wouldn't work on a computer, but Winthrop is a stubborn sort. It took me six weeks to potty-train him.

It sure didn't look like we'd be opening the cafe that day. So I wiped the green slime from my glasses and crawled out the window and padded on over to the Atrium, where I grabbed a cup of espresso and a Prince Puckler's chocolate milk shake for breakfast. I had Queenie, one of our Model IIIs, along, so I plugged her in and booted up Adventure International's Sea Dragon.

Well, naturally several shoppers wandered over to see what was happening, and before I knew it they'd pushed me aside and were cruising along like so many underwater Ahabs. What with all of the rain perpetually dropping from the sky, these people seemed to have a particular affinity for the video deep, and pretty soon they'd blown Winthrop's high score off the board. Some fellow who called himself Mad Max wiped out the reactor five times and racked up 147,910 points.

Mad Max was a hippie tree planter who hadn't been out of the woods since 1976, which was when he finally got back from Woodstock. He thought Queenie was pretty interesting (he called her a "souped-up tv"), and wanted to know if anybody'd ever gotten a score higher than his. I had no idea. So we went back to the van and woke up Winthrop and asked him, but he had no idea either.

Well, says I, why don't we put out a call in Gamer's Cafe? But Winthrop was a bit miffed that this guy, who didn't know a chip from cheddar cheese, had cleaned his clock, and wasn't too receptive. Then Mad Max said, why not publish Winthrop's high scores for other games? This suggestion thawed Winthrop pretty quickly.

So I started scrounging around the van for the bits and pieces of paper Winthrop filed his scores on, and typed them on a separate sheet of paper, which I imagine the guys at 80 will print as a table or figure or something. (See Something 1.) If any of you out there have done better, or have a super score for a game not on the list, send a photo of the screen to the Gamer's Cafe, care of 80 Micro.

About the time we heard a knock on the window. It was the mailman. Lord only knows how the 80 office manages to track us down. Winthrop was all excited—he loves answering mail from our readers—but the mail consisted of a flyer from the Church of Otherly Love, a free sample of a new fingernail remover, and a press release from Hayden Software. None of it interested Winthrop much, so when Mad Max suggested they go out for a mushroom pizza, Winthrop jumped at the offer.

Since it seemed likely that the Hayden release would have something to do with micros, I opened it up, and found an interesting couple pages on their Kamikaze Shootout. Kamikaze is a new arcade game for the Apple, and Hayden is sponsoring a contest that will culminate (i.e., end) in a showdown in San Francisco for 5,000 smackers. The finalists will be the five people who send in the highest scores by January 31, 1983; they have to verify their scores with a photo of the screen.

You might be wondering what's to stop somebody from messing around with the code and posting a high score illegally. I wonder if you're wondering that because I wondered it too. So I picked the lichen from my pants and headed for the nearest phone to call Jim Hunter, software editor at Hayden.

Well, the honchos at Hayden are pretty laid back about the whole thing. Jim says they've got a protection scheme built into the program, and a

Game	Player	Score
Eliminator	Winthrop	59,600
Sea Dragon	Mad Max	147,910*
Swamp Wars	Winthrop	39,200**
Armored Patrol	Winthrop	81,000†
Galaxy Invaders	Winthrop	1,000,000††
Cosmic Fighter	Winthrop	103,980

Novice mode. Max got 69,480 in the expert mode.

Something 1. A list of the most-frequently played games at the Gamer's Cafe and their high scores.

<sup>\*\*</sup>Winthrop got through all nine swamps, too.

<sup>†</sup>Method I. Winthrop racked up 281,000 points using Method II.

<sup>†</sup>Winthrop still had six ships left, but he got bored.



# After three years of selling my Model I and Model III programs, I've earned back my development costs. So I can lower the price.

Now I'm offering my Model I and Model III programs for \$75 each.

They've been checked out by thousands of TRS-80\* users, most of whom get in touch with me, Irwin Taranto. Thousands of phone calls later, these systems are completely developed, checked out, glitch-free.

When people call, we've heard all the questions and we can answer them right off. I don't have to get on the phone and work through problems like I used to.

Since I'm getting off so easy, the least I can do is drop the price-50% for General Ledger, 25% for the rest.

These are my Model I and Model III programs: **Accounts Payable** It links to the General Ledger, calculates and prints checks and makes reports. It's an invoice-linked system.

**Accounts Receivable** It keeps track of billed and unbilled invoices, open and closed items and aging. It prints statements and links to the General Ledger.

**General Ledger** It keeps track of data by month, quarter, year and the previous three quarters. It even includes a Cash Journal.

**Inventory Control** It gives an immediate readout on any item inquiry, including quantity and dollar total.

**Invoicing** It prints your detailed invoices and links to Accounts Receivable and the General Ledger.

**Payroll** It keeps the files, computes pay and deductions, prints forms and checks, figures taxes, overtime and piecework pay in any state tax routine, and prints the 941-A and W-2 forms.

They're all yours, for \$75 each. You also need documentation when you run our systems. The Osborne books—one for Accounts Payable and Receivable, one for General Ledger, one for Payroll—cost \$20 each. Our invoicing book costs \$10.

Just send me the coupon, or call us toll free. We'll ship within 48 hours.

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Add \$4.50 per order for handling	
6% tax (California only)	
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If you need the books, add \$20 each. The invoici  Mastercharge Visa No.  Please send me information on other Taranto programs, including TRS-80 Model II accounti	Expires
Your name	
Company name	
Address	
City/State/Zip	
	ranto

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message that will flash onto the screen at 50,000 points. But basically they're relying on the integrity of the contestants. Besides, he points out, who's going to want to get to San Francisco by cheating and then get humiliated at the national finals? (He's lucky he didn't ask Winthrop that question.)

In any case, Jim and I marveled at what a great idea it was, and wondered why other companies didn't do it. Jim pointed out that such a contest requires a lot of up-front cash for advertising and promotion (not to mention the prizes), and that only the larger companies could afford to risk the loss. Still, it sure would be nice if somebody did something similar for us TRS-80 pilots.

Speaking of Hayden, Jim also says that they won't be coming out with too much TRS-80 software in the near future. It seems they've got eight or nine Apple and Atari games in the works that they need to polish off. Jim acknowledged, however, that the company can't afford to ignore three quarters of a million of us, so maybe some time in the future they'll toss something our way.

While I was on the phone, I decided to make one of my rare yet infre-

quent calls to 80 Micro headquarters. One of the editors answered with, "Casey's Bar and Grill, Casey speaking." Jeez, I thought, those folks at 80 Micro sure are a pack of cards. Anyway, I asked about these rumors going around about Spectral Associates, and the editor said sure enough, they're true. Spectral is coming out with a machine-language hi-res graphics adventure for the Color Computer called Revenge of the Hawk, and the people at Spectral say it's going to set a new standard in adventure games. We've all heard that one before, so we'll see. They've also got Omega Race ready to go on line. Both Hawk and Race should be out at any time. In addition, they have a machine-language hi-res Donkey Kong play-alike in the works for you weird arcade parlor bums.

After I got all the straight dope on Spectral, I asked how things were going at 80 Micro, and the guy on the line said "80 what?" I thought at this point that the joke had gone too far, so I shouted at the guy for a little while, and he shouted back. It finally came to light that I really had called Casey's Bar and Grill. These bartenders think they know everything.

When I got back to the van, Winthrop and Mad Max were staring happily at a blank VDT, giggling and passing a bottle of margaritas back and forth. I asked what was going on, and Winthrop said something about the hilarious ultrasonic hum. Mad Max asked me if I wanted a piece of mushroom pizza. Only thing was, they'd somehow lost the pizza and only the mushrooms were left. I politely declined.

Well, I was getting pretty sick of the rain, so I figured that this was as good a time as any to hit the road. We needed some place nice and sunny where we could set up the cafe once again and sip coffee to the sounds of twangy Spanish guitars. So I wiped the moss from the windshield and headed for Route 5 South.

It wasn't until Klamath that I realized we still had Max in the van. I thought of saying something, but he was asleep, and I didn't want to wake him. Besides, this'll be good for his soul. How long can a guy plant trees before he becomes one?

That's it for this month. Keep those cards and letters pouring in. ■

#### RIBBON SALE **NEW PRINTERS ADDED! FIND YOURS BELOW** EXACT REPLACEMENTS, LONG-LIFE, HEAVY INKING Good This Month RADIO SHACK CENTRONICS EPSON ANADEX BASE 2 HEWLETT PACKARD MALIBU IBM NEC C ITOH IDS PRINTER RIBBON INSERTS EZ-LOAD™ RELOADS **NEW CARTRIDGES** SILVER DOLLAR EXACT REPLACEMENTS made in our own shop feature Long-Life and Heavy Inking. Our instructions DROP IN, NO WINDING! SIZE MAKE, MODEL NUMBER You SEND your used CARTRIDGES to us. We RELOAD them for you WIND to LOAD Inches (Contact us if your printer is not listed. We can probably WHY DO WE SELL THESE? to availability \*) This is the type ribbon you get if you order from our fellow advertisers. We sell them hv RELOAD your old cartridges. Yards for less since we make them ourselves. Do **ANADEX 9000 Series** 1/2 x 30 \$21/3 \$78/12 \$10/1 \$9 ea./2 or more you really like the mess and inconvenience of unwinding and dumping this type ribbon into a wastebasket or out on a newspaper BASE 2 \$9/1 1/2 x 20 \$18/3 \$8 ea./2 or more \$66/12 \$30/2 \$87/6 \$168/12 and/or winding it into your cartridge? We don't know why these are being sold. Computers should simplify your life, not make it more complex just to save a few pennies. You are welcome to order these **CENTRONICS 7 - MEG** 5/16 x 70 \$11/1 \$10 ea./2 or more \$25/2 \$72/6 \$140/12 702/703/704/753 HP-MALIBU 2608-2631 3/4 x 60 \$20/1 \$18 ea./2 or more **RADIO SHACK** if you cannot afford our EZ-LOAD INSERTS, RELOADS, or NEW CA DAISY WHEEL II Carbon Film (26-1419) ¼ x 130 \$25/6 \$48/12 \$270/72 \$15/3 \$18/3 \$70/12 \$408/72 RIDGES. But BEWARE! You now know how to avoid disappointment. One more caution: COLORS Red Green 1/4 x 130 \$30/6 \$58/12 \$324/72 \$18/3 \$21/3 \$82/12 \$480/72 be sure to check the length of any ribbon BEFORE you buy it. For instance, an MX-100 ribbon should be 30 yards long, not 20 as in the MX-80. Long-Life Fabric (1449) 4 x 25 NOT EZ \$24/3 \$47/6 \$90/12 \$20/2 \$58/6 \$112/12 \$9/1 \$8 ea./2 or more LP I-II-IV 700 Zip-Pack 9/16 x 16 \$13/3 \$48/12 (1413) 730/737/739/779 LP III-V (26-1414) ½ x 18 \$18/3 JAM RESISTANT \$66/12 \$8 ea./2 or more \$9/1 \$25/2 \$75/6 \$150/12 \$12/3 \$44/12 \$252/72 LP VI-VIII (26-1418) 5/16 x 14 \$62/12 \$9/1 \$8 ea./2 or more \$22/2 \$66/6 \$132/12 \$11/3 \$40/12 \$228/72 LP VII (26-1424) Inker Loop \$16/2 \$48/6 \$96/12 EPSON MX 70-80 IBM 1/2 x 20 \$18/3 \$66/12 \$9/1 \$8 ea./2 or more \$18/2 \$52/6 \$100/12 \$12/3 \$44/12 \$252/72 MX 100 1/2 x 30 \$21/3 \$78/12 \$10/1 \$9 ea./2 or more \* \$30/2 \* \$18/3 \$66/12 \$360/72 C.ITOH Prowriter 1/2 x 18 \$18/3 \$66/12 \$9/1 \$8 ea./2 or more **MODEL II 8" GAME DISCS** IDS Paper 450/46 Volume 2 ½ x 35 \$11/1 \$10 ea./2 or more Biorhythms, Trap Ugly, Bingo DATA ROYAL 5000 ½ x 16 \$18/3 \$66/12 \$9/1 \$8 ea./2 or more Rip Cord, Yacht Sea \$25 EACH Towers, Blackiack NEC 8023 Series ½ x 18 \$18/3 \$66/12 Concentration & 4 more Farkle, Pony & 3 more \$8 ea./2 or more Spinwriter Fabric ⅓ x 18 \$18/3 \$66/12 SEND CHECK, MONEY ORDER, or COD TO: \$8/1 \$7 ea./2 or more MS Carbon Film ½ x 130 \$25/6 \$48/12 \$15/3 BCCOMPCO COLORS 1/4 x 130 \$30/6 \$58/12 \$324/72 \$18/3 800 South 17 Box 246 WORRIED ABOUT ORDERING BY MAIL? Relax. We've been in business for many years and can please the WORNIED ABOUT ONDERING BY MAIL 2 Heax. We ve been in business for many years and can please the smallest and largest account. You receive some of the finest ribbons available made of our own exclusive IMAGE PLUS + riv fabric and carbon film. Our ribbons fit your printer exactly. COMPARE, but BEWARE! We order all our competitor's products and are amazed at what we get. Have you ever reviewed a new fabric ribbon you had to unwind and dump out on the table before you could use it? We have. Or, carbon film iserts that had no end-of-ribbon sensor? Or, 7-meg cartridges with only HALF enough ribbon at full retail? Our only business is RIBBON manufacturing and distribution. We use the latest state-of-the-art production. SUMMERSVILLE, MO 65571 (417) 932-4196 WE PAY UPS SHIPPING ON PREPAID ORDERS. PLEASE INCLUDE STREET ADDRESS FOR UPS DELIVERY, ADD equipment and are blessed with a fine, dedicated staff. We fully quarantee all our products because we make \$1.00 FOR POSTAL, APO, FPO, OR AK, AS, CM, GU, HI, them ourselves. You must be completely satisfied, period. Our ribbons are made fresh daily and shipping them. Write for our brochure and newsletter "INK SPOTS". PR, TT, VI, CANADA OR MEXICO. FOREIGN ADD 10%,



#### I've paid off the costs on my Model II TRSDOS' systems, too.

## So now they're 50% cheaper.

A couple of months ago, I realized I'd paid off the development costs on my Model I and Model III programs. I could lower the price without cutting back one bit on my support.

The response was fantastic. Enough so that I can do the same for the TRSDOS versions of my Model II/16 programs.

These are my systems, and my new prices.

#### **General Ledger**

It gives year-to-year comparisons in dollars and percentages. It figures budgets and even has a report generator. It was \$299, it's now \$150.

#### **Accounts Payable/Purchase Order**

It generates purchase orders and posts the items to payable when the goods come in. It calculates and prints checks and aged ledger reports, linking fully to the General Ledger. Was \$349, now \$175.

#### **Accounts Receivable**

You can choose either an open item system or a balance forward system which works on a cash or an accrual basis. The open item system does invoicing and sales analysis by product code and figure in salesmen's commissions. They both generate mailing lists by customer code and zip code for up to 2000 customers. Open Item/Invoicing was \$349, it's now \$175. Balance Forward was \$399, it's now \$200.

#### Payroll/Job Costing

A huge capacity. It accommodates up to 300 employees in multiple departments, with any state tax routine. It also figures piecework, overtime and tips. Was \$299, now \$150. With job costing option, was \$399, now \$200.

#### **Inventory Control**

It stores up to 5000 items. It reports by vendor, tells you when you're out of stock, or when you need to reorder. It updates price or cost automatically and integrates fully with my invoicing system. Originally \$399, now \$200.

These programs all work with one, two, three or four-drive and hard disk systems. They're designed to integrate with the General Ledger, and, where it helps, with each other.

They also get what I firmly believe is the most thorough support in the microcomputer industry. If you have a problem, call us and we'll straighten it out. Even if I have to do it myself, personally, right there on the phone.

Michael Tannenbaum, the "80 Accountant" thought my systems were "a very impressive product at a very reasonable price." Even when they cost twice as much as they do now.

Just call, and take advantage of me.

**-** 70



121 Paul Drive, San Rafael CA 94903 Outside California, toll free (800) 227-2868. In California, (415) 472-2670.
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### Voice-Controlled Typewriter

by Mike Rigsby

Some handicapped people have disabilities that prevent them from writing or typing, yet their intellect is normal. This program lets you produce printed text by verbal control. Required equipment includes a TRS-80 Model I or III, a cassette recorder, and a printer. You don't have to be able to utter words; controlled verbal utterances or the tapping of a pencil upon the table will suffice.

A special feature of this software is the speed-control function. You can move the cursor (the heart of the operation) faster or slower by verbal command. You set your own pace.

To start the program, load Voice-

# The physically handicapped can produce printed text with this sound-controlled program.

controlled Typewriter, type Run, and press enter. The program begins and indicates that the auxiliary microphone and plugs, as well as any tape, should be removed from the tape recorder. Next press the record and play keys while simultaneously pushing in the silver interlock button in the left rear of the recording well. Press any key and the program

will operate, under sound control.

A cursor moves across the top of the screen and when it is over a row with a desired letter, utter a short sound and it will travel down that row. When the cursor is at the left of the desired letter, utter another sound and that letter will

#### The Key Box

Model I or III 16K, 32K RAM Cassette or Disk Basic Printer

#### Program Listing

```
1 GOTO 622
  2 CLEAR 400
 3 B=0
  4 DIMA$(70)
  5 Q1=30
 6 Q=5Ø
 7 FOR A=0 TO 69
  8 A$(A)="
  9 NEXT A
 10 CLS
 11 PRINT@5, "*": PRINT@13, "*": PRINT@21, "*": PRINT@29, "*": PRINT@37, "
*": PRINT@45, "*": PRINT@53, "*"
12 PRINT@133,"A":PRINT@141,"D":PRINT@149,"C":PRINT@157,"B":PRINT @165,"SPACE":PRINT@173,"0":PRINT@181,"5"
13 PRINT@197,"E":PRINT@205,"H":PRINT@213,"F":PRINT@221,"J":PRINT @229,".":PRINT@237,"1":PRINT@245,"6"
14 PRINT@261,"I":PRINT@269,"N":PRINT@277,"G":PRINT@285,"K":PRINT
  @293,",":PRINT@301,"2":PRINT@309,"7
 15 PRINT@325, "O": PRINT@333, "S": PRINT@341, "L": PRINT@349, "M": PRINT
18357, "PRINT":PRINT@365, "3":PRINT@373, "8"

16 PRINT@389, "u":PRINT@397, "T":PRINT@405, "P":PRINT@413, "Q":PRINT@421, "ERASE":PRINT@429, "4":PRINT@437, "9"

17 PRINT@469, "R":PRINT@477, "V":PRINT@485, "X":PRINT@501, "SPEED"

18 PRINT@533, "Y":PRINT@541, "W":PRINT@549, "Z"

19 SET_106, 410, SET_107, 410, SET_108, SET_108, SET_108, SET_108, SET_108, SET_108, SET_108, SET_108, SET_108, SET_10
 19 SET(106,41):SET(107,41):SET(108,41):SET(109,41):SET(110,41):S
 ET(111,41):SET(112,41):SET(113,41):SET(114,41):SET(115,41):SET(1
 16,41):SET(117,41):SET(118,41):SET(119,41):SET(120,41):SET(121,4
  1):SET(127,41):SET(126,41)
```

```
20 POKE 15364,191
21 POKE15412,128
22 FOR X=1 TO Q
23 OUT255,00
24 Y=INP(255)
25 IF Y>200THEN 70
26 NEXTX
27 POKE 15372,191
28 POKE15364,128
29 FOR X=1 TO Q
30 OUT255,00
31 Y=INP(255)
32 IF Y>200 THEN 127
33 NEXT X
34 POKE15380,191
35 POKE 15372,128
36 FOR X=1 TO Q
37 OUT255,00
38 Y=INP(255)
39 IF Y>200 THEN 184
40 NEXT X
41 POKE 15388,191
42 POKE15380,128
43 FOR X=1 TO Q
44 OUT 255,00
45
    Y=INP(255)
    IF Y>200 THEN 263
46
47 NEXT X
```

Listing continues

#### MAILING LIST SYSTEM \$119.95

FOR TRS-80 (Tandy Trademark) Model I and III

#### WHAT SETS OUR SYSTEM APART?...

- Our system is configured specifically for large mailing lists (or small) on floppy disk drives. Some other major systems run on floppies but are really intended for use on hard disk drives. Such a system assumes that you have vast amounts of on line disk storage capacity...the continuity of the data is limited to what you can have on line at one time. To get the real benefit of such a system, one usually has to purchase expanded track/density floppy disk drives and even then the problem occurs when all the drives are filled with data. We have neatly solved this problem by allowing all your data disks to be maintained in continuous order...even though, due to the limitations of your drives, the list may be too large to all be "on line" at one time. Thus our system accomodates extremely large lists using your existing drives and yet avoids the "segmented" data problems of the hard disk approach.
- While it is fashionable to advertise all-machine-code systems, our system is primarily written in BASIC...with embedded machine code for the speed sensitive areas. What this means is that our system is easy to modify, yet extremely fast. This is very important since many users like to have custom modifications made (either by them or us) so as to fit some unique requirement. Our manual has a section devoted exclusively to such modifications...Remember all-machine-code systems are extremely difficult to modify.
- Continuity of the ordered data (even data spanning many disks) is not limited to a "session", but is permanent
- Optional "backing up" of your data as-you-go is an integral part of the system and is not restricted to the end of a session. This is true even for deletions.
- The length of our data fields are more than adequate to accomodate even your longest names/addresses.
- Adjusts to a 32K memory although full use is made of a 48K memory...Can be used with any DOS including TRSDOS.
- The program disk does not have to stay on line, thus freeing more space for data storage.
- Load and scroll through entire entries or selected fields. Edit as you scroll or go directly (takes about 2 sec.) to a specific entry and edit or delete.
- Our automatic repeat feature allows often used names/ addresses to be entered with a single key stroke.
- Each disk entry optionally "remembers" how many mailings have been made for that particular entry...Can be tied in with purge/select.
- Continuing expert support just a phone call away. You will be able to discuss your problems/modifications with the authors.
- Money back guarantee if not fully satisfied.

#### **ADDITIONAL FEATURES:**

- Simple to use, even for the novice...menu oriented
- Permits 2260 names "on-line" with 40 track double density drives and almost 5000 names with 80 track drives. The older 35 single density drives permit 1025 on-line entries...made possible with our unique data compression techniques.
- Super fast sort by alph, or zip order (8 sec. for 1000 entries).
   Both orders can exist simultaneously on disk.
- High speed recovery of entries from disk...speed of sort is meaningless if retreival from disk is slow. Ours pulls in over 11 per sec!
- Master list printout of your list in several formats (not just a rehash of labels)...extremely useful.
- Zip order is "sub-alphabetized"
- Less than 5 digit zips have leading 0's appended.
- Supports 9 digit zips, Canadian zips, and foreign abbrev
- Optional second address line
- Optional reversal of names about commas. This permits disk storage in last-name-first order to facilitate meaningful order-

- ing while the printout will be in "natural" order
- Permits telephone, account, and/or serial numbers, etc.
- Prints on envelopes or labels 1, 2, 3 or 4 across
- Can print individual labels at time of creation or editing
- Test label/envelope printing allows you to make vertical and horizontal adjustments with ease...
- Transfers old files to our system.

LOOK!

- Selective printout by specific zips or zip ranges
- Plenty of user defined fields with provisions for simultaneously purging and/or selecting the printout...even allows for inequalities...Powerful and easy to use.
- Editing is simply and fast...direct access or automatic search...Batch transfer or edited entries to backup disks.
- Optionally provides for duplicate labels
- Deleted entries have "holes" on disk filled automatically and alph. order is still maintained!
- All labels optionally support an "Attn" line with provisions for multiple entries. This permits mail to be sent to several people at given addresses ...conserves disk space
- All 0's are replaced by easier to read 0's in addresses.
- Continuous display of number of labels/envelopes printed.
- Extensive use of error traps...even recovers from a power failure during a printout.
- Extensive assortment of extra cost options for customized master list printout (in addition to the standard one mentioned above), transfer of entries between disks, summary reports, and "publisher's" type multiple list label printouts.
- Hardware requirements...32K, printer, and 1 or 2 drives

#### FORM LETTER (Use with Mail List System) \$39.95

Create letters and store on disk with provisions for later retreival and additions. Then print your letters using your mailing list.

- Same select and purge features as mailing list system.
- Select either continuous fanfold or "cut sheet" paper.
- Selectable tabing, test printing, and paging
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- Greetings are selectable by codes on mailing list. Options include Mr./Mrs., First/Last Name, global, or user defined.

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Listing continued 305 IF Y>200 THEN 543 133 FOR X=1 TO Q 219 FOR X=1 TO Q1 306 NEXT X 134 OUT255,00 48 POKE 15396,191 220 NEXT X 49 POKE15388,128 221 B\$="L" 307 POKE 15772,191 135 Y = INP(255)50 FOR X=1 TO O 308 POKE 15708,128 222 C=15700 136 IF Y>200 THEN 543 309 FOR X=1 TO Q1 51 OUT255,00 223 FOR X=1 TO O 137 NEXT X 224 OUT255,00 310 NEXT X 138 POKE 15564,191 139 POKE 15500,128 52 Y=INP(255) 311 B\$="0" 53 IF Y>200 THEN 342 225 Y = INP(255)312 C=15772 54 NEXT X 140 FOR X=1 TO Q1 226 IF Y>200 THEN 543 55 POKE 15404,191 227 NEXT X 313 FOR X=1T00 141 NEXT X 56 POKE15396,128 142 B\$="H" 228 POKE 15764,191 314 OUT255,00 57 FOR X=1 TO Q 58 OUT 255,00 229 POKE 15700,128 315 Y=INP(255) 143 C=15564 316 IF Y>200 THEN 543 144 FOR X=1 TO Q 230 FOR X=1 TO 01 317 NEXT X 318 POKE 15836,191 319 POKE 15772,128 59 Y = INP(255)145 OUT255,00 231 NEXT X 60 IF Y>200 THEN 419 146 Y=INP(255) 232 BS="P" 61 NEXT X 147 IF Y>200 THEN 543 233 C≈15764 320 FOR X=1 TO Q1 62 POKE 15412,191 148 NEXT Х 234 FOR X=1 TO Q 63 POKE 15404,128 149 POKE 15628,191 321 NEXT X 235 OUT255,00 150 POKE 15564,128 64 FOR X=1 TO Q 236 Y=INP(255) 237 IF Y>200 THEN 543 322 B\$="Q" 65 OUT255,00 323 C=15836 151 FOR X=1 TO Q1 324 FOR X=1 TO Q 66 Y=INP(255) 238 NEXT X 152 NEXT X 325 OUT255,00 153 B\$="N" 67 IF Y>200 THEN 476 239 POKE 15828,191 68 NEXT X 326 Y=INP(255) 154 C=15628 240 POKE 15764,128 69 GOTO 20 327 IF Y>200 THEN 543 155 FOR X=1 TO Q 241 FOR X=1 TO Q1 328 NEXT X 329 POKE 15900,191 70 POKE 15364, 128 71 POKE 15492,191 156 OUT255,00 242 NEXT X 157 Y=INP(255) 243 BS="R" 330 POKE 15836,128 72 FOR X=1 TO Q1 158 IF Y>200 THEN 543 244 C=15828 73 NEXT X 159 NEXT X 331 FOR X=1 TO Q1 245 FOR X=1 TO Q 160 POKE 15692,191 74 B\$="A" 332 NEXT X 246 OUT255,00 333 B\$="W" 75 C=15492 161 POKE 15628,128 247 Y = INP(255)334 C=15900 76 FOR X=1 TO Q 162 FOR X=1 TO Q1 248 IF Y>200 THEN 543 77 OUT255,00 335 FOR X=1 TO O 249 NEXT X 163 NEXT X 336 OUT255,00 78 Y=INP(255) 164 B\$="S" 250 POKE 15892,191 79 IF Y>200 THEN 543 337 Y=INP(255) 251 POKE 15828,128 165 C=15692 80 NEXT X 252 FOR X=1 TO Q1 338 IF Y>200 THEN 543 166 FOR X=1 TO O 339 NEXT X 81 POKE 15556,191 167 OUT255,00 253 NEXT X 82 POKE 15492,128 254 BS="Y 340 POKE 15900,128 168 Y=INP(255) 83 FOR X=1 TO Q1 169 IF Y>200 THEN 543 255 C=15892 341 GOTO 20 84 NEXT X 342 POKE 15524,191 170 NEXT X 256 FOR X=1 TO Q 85 B\$="E" 343 POKE 15396,128 257 OUT255,00 171 POKE 15756,191 86 C=15556 344 FOR X=1 TO Q1 172 POKE 15692,128 258 Y=INP(255) 87 FOR X=1 TO Q 345 NEXT X 173 FOR X=1 TO Q1 259 IF Y>200 THEN 543 88 OUT255,00 174 NEXT X 260 NEXT X 346 B\$=CHR\$(176) 89 Y=INP(255) 175 B\$="T" 347 C=15524 261 POKE 15892,128 90 IF Y>200 THEN 543 348 FOR X=1 TO Q 176 C=15756 262 GOTO 20 91 NEXT X 349 OUT255,00 177 FOR X=1 TO Q 263 POKE 15388,128 92 POKE 15620,191 350 Y=INP(255) 178 OUT255,00 264 POKE 15516,191 93 POKE 15556,128 351 IF Y>200 THEN 543 352 NEXT X 179 Y=INP(255) 265 FOR X=1 TO Q1 94 FOR X=1 TO Q1 180 IF Y>200 THEN 543 266 NEXT X 353 POKE 15588,191 354 POKE 15524,128 95 NEXT X 181 NEXT X 267 B\$="B" 96 B\$="I 182 POKE 15756,128 268 C=15516 97 C=15620 183 GOTO 20 355 FOR X=1 TO Q1 269 FOR X=1 TO Q 184 POKE 15380,128 185 POKE 15508,191 98 FOR X=1 TO Q 356 NEXT X 270 OUT255,00 99 OUT255,00 357 BS=" 271 Y = INP(255)100 Y=INP(255) 358 C=15588 186 FOR X=1 TO Q1 272 IF Y>200 THEN 543 101 IF Y>200 THEN 543 359 FOR X=1 TO Q 187 NEXT X 273 NEXT X 102 NEXT X 360 OUT255,00 188 BS="C" 274 POKE 15580,191 103 POKE 15684,191 189 C=155Ø8 275 POKE 15516,128 361 Y=INP(255) 104 POKE 15620,128 362 IF Y>200 THEN 543 190 FOR X=1 TO Q 276 FOR X=1 TO Q1 105 FOR X=1 TO Q1 191 OUT255,00 363 NEXT X 277 NEXT X 106 NEXT X 192 Y=INP(255) 278 B\$="J" 364 POKE 15652,191 107 B\$="O" 365 POKE 15588,128 193 IF Y>200 THEN 543 279 C=1558Ø 194 NEXT X 195 POKE 15572,191 196 POKE 15508,128 108 C=15684 366 FOR X=1 TO Q1 280 FOR X=1 TO Q 109 FOR X=1 TO Q 367 NEXT X 281 OUT255,00 110 OUT255,00 368 B\$=" 282 Y = INP(255)111 Y=INP(255) 369 C=15652 283 IF Y>200 THEN 543 197 FOR X=1 TO Q1 112 IF Y>200 THEN 543 370 FOR X=1 TO Q 284 NEXT X 198 NEXT X 113 NEXT X 199 B\$="F" 285 POKE 15644,191 371 OUT255,00 114 POKE 15748, 191 286 POKE 15580,128 200 C=15572 372 Y = INP(255)115 POKE 15684,128 201 FOR X=1 TO 0 373 IF Y>200 THEN 543 287 FOR X=1 TO Q1 116 FOR X=1 TO Q1 202 OUT255,00 374 NEXT X 288 NEXT X 117 NEXT X 203 Y=INP(255) 289 B\$="K" 375 POKE 15716,191 118 B\$="U" 204 IF Y>200 THEN 543 290 C=15644 376 POKE 15652,128 205 NEXT X 377 FOR X=1 TO Q1 119 C=15748 291 FOR X=1 TO Q 206 POKE 15636,191 207 POKE 15572,128 120 FOR X=1 TO Q 378 NEXT X 292 OUT255,00 379 C=15716 121 OUT255.00 293 Y=INP(255) 380 FOR X=1 TO Q 294 IF Y>200 THEN 543 122 Y=INP(255) 208 FOR X=1 TO Q1 381 OUT255,00 295 NEXT X 123 IF Y>200 THEN 543 209 NEXT X 124 NEXT X 210 B\$="G" 296 POKE 15708,191 382 Y=INP(255) 125 POKE 15748,128 211 C=15636 383 IF Y>200 THEN 553 297 POKE 15644,128 126 GOTO 20 212 FOR X=1 TO Q 384 NEXT X 298 FOR X=1 TO 01 385 POKE 15780,191 386 POKE 15716,128 127 POKE15372,128 213 OUT255,00 299 NEXT X 128 POKE15500,191 214 Y=INP(255) 300 B\$="M" 215 IF Y>200 THEN 543 129 FOR X=1 TO Q1 38/ FOR X=1 TO Q1 301 C=15708 130 NEXT X 216 NEXT X 302 FOR X=1 TO Q 388 NEXT X 131 B\$="D" 217 POKE 15700,191 389 C=15780 303 OUT255,00 132 C=15500 218 POKE 15636,128 304 Y = INP(255)Listing continues



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Power Draw A super-easy screen display generator. Allows you to save screens in Basic, Packed String, Load file, or /CMD file. Give a professional look to your program. Regularly	Package by New Classics Software. Considered to be the best Pascal Package available for the TRS-80! Regular Price \$99.95, Holiday Special (113008) \$79.95!!
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Listing continued 476 POKE 15540,191 390 FOR X=1 TO Q 477 POKE 15412,128 391 OUT255,00 478 FOR X=1 TO 01 392 Y=INP(255) 479 NEXT X 393 IF Y>200 THEN 568 480 B\$="5" 394 NEXT X 481 C=15540 395 POKE 15844,191 482 FOR X=1 TO Q 396 POKE 15780,128 483 OUT255,00 39/ FOR X=1 TO Q1 484 Y=INP(255)398 NEXT X 485 IF Y>200 THEN 543 399 BS="X" 486 NEXT X 400 C=15844 487 POKE 15604,191 401 FOR X=1 TO O 488 POKE 15540,128 402 OUT255,00 489 FOR X=1 TO Q1 403 Y=INP(255) 490 NEXT X 404 IF Y>200 THEN 543 491 B\$="6" 405 NEXT X 492 C=15604 406 POKE 15908,191 493 FOR X=1 TO Q 407 POKE 15844,128 494 OUT255,00 408 FOR X=1 TO Q1 495 Y=INP(255) 409 NEXT X 496 IF Y>200 THEN 543 410 BS="Z" 497 NEXT X 411 C=15908 498 POKE 15668,191 412 FOR X= 1 TO Q 499 POKE 15604,128 413 OUT255,00 500 FOR X=1 TO Q1 414 Y=INP(255) 501 NEXT X 415 IF Y>200 THEN 543 502 B\$="7" 416 NEXT X 503 C=15668 417 POKE 15908,128 504 FOR X=1 TO Q 418 GOTO 20 505 OUT255,00 419 POKE 15532,191 506 Y=INP(255) 420 POKE15404,128 507 IF Y>200 THEN 543 421 FOR X=1 TO Q1 508 NEXT X 422 NEXT X 509 POKE 15732,191 510 POKE 15668,128 423 B\$="0" 424 C=15532 511 FOR X=1 TO Q1 425 FOR X=1 TO Q 512 NEXT X 426 OUT255,00 513 B\$="8" 427 Y=INP(255) 514 C=15732 428 IF Y>200 THEN 543 515 FOR X=1 TO Q 429 NEXT X 516 OUT255,00 430 POKE 15596,191 517 Y=INP(255) 431 POKE 15532,128 518 IF Y>200 THEN 543 432 FOR X=1 TO Q1 519 NEXT X 433 NEXT X 520 POKE 15796,191 434 B\$="1 521 POKE 15732,128 435 C=15596 522 FOR X=1 TO Q1 436 FOR X=1 TO Q **523 NEXT X** 437 OUT255,00 524 B\$="9" 438 Y=INP(255) 525 C=15796 439 IF Y>200 THEN 543 526 FOR X=1 TO Q 440 NEXT X 527 OUT255,00 441 POKE 15660,191 528 Y=INP(255) 442 POKE 15596,128 529 IF Y>200 THEN 543 443 FOR X=1 TO Q1 530 NEXT X 444 NEXT X 531 POKE 15860,191 445 B\$="2" 532 POKE 15796,128 446 C=15660 533 FOR X=1 TO Q1 447 FOR X=1 TO Q **534 NEXT X** 448 OUT255.00 535 C=15860 449 Y=INP(255) 536 FOR X=1 TO Q 450 IF Y>200 THEN 543 537 OUT255,00 451 NEXT X 538 Y=INP(255) 452 POKE 15724,191 539 IF Y>200 THEN 573 453 POKE 15660,128 540 NEXT X 454 FOR X=1 TO Q1 541 POKE 15860,128 455 NEXT X 456 B\$="3 542 GOTO 20 457 C=15724 543 GOTO544 544 POKEC, 128 458 FOR X=1 TO Q 545 PRINT@(896+B),B\$ 459 OUT255,00 546 IF B\$=CHR\$(176) THEN B\$=" " 460 Y=INP(255) 547 A\$(B) =B\$ 461 IF Y>200 THEN 543 548 B=B+1 462 NEXT X 549 IF B=62 THEN 553 463 POKE 15788,191 550 FOR X=1 TO 20 464 POKE 15724,128 551 NEXT X 465 FOR X=1 TO Q1 552 GOTO 20 466 NEXT X 553 C\$=A\$(0)+A\$(1)+A\$(2)+A\$(3)+A\$(4)+A\$(5)+A\$(6)+A\$(7)+A\$(8)+A\$( 467 B\$="4" 9) +A\$(10) +A\$(11) +A\$(12) +A\$(13) +A\$(14) +A\$(15) +A\$(16) +A\$(17) +A\$(18 468 C=15788 )+A\$(19) 469 FOR X=1 TO Q 554 D\$=A\$(20)+A\$(21)+A\$(22)+A\$(23)+A\$(24)+A\$(25)+A\$(26)+A\$(27)+A 470 OUT255,00 \$(28) +A\$(29) +A\$(30) +A\$(31) +A\$(32) +A\$(33) +A\$(34) +A\$(35) +A\$(36) +A\$ 471 Y=INP(255) (37) +A\$(38) +A\$(39) 472 IF Y>200 THEN 543 555 E\$=A\$(40)+A\$(41)+A\$(42)+A\$(43)+A\$(44)+A\$(45)+A\$(46)+A\$(47)+A 473 NEXT X \$(48) +A\$(49) +A\$(50) +A\$(51) +A\$(52) +A\$(53) +A\$(54) +A\$(55) +A\$(56) +A\$ 474 POKE 15788,128 475 GOTO 20

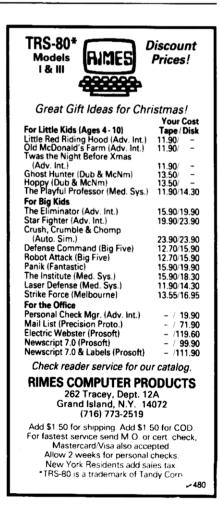
```
Listing continued
 (57) +A$(58) +A$(59)
556 POKE15716,128
557 F$=A$(60)+A$(61)+A$(62)
558 G$=C$+D$+E$+F$
559 LPRINTG$
560 PRINT@896,"
561 FOR A=ØTO69
562 A$(A)=
563 NEXT A
564 B=u
565 FOR A=Ø TO 500
566 NEXT A
567 GOTO 20
568 B=(B-1): IF B<0 THEN B=0:A$(B)=" "
569 POKE 15780,128
570 PRINT@(896+B)," "
571 GOTO 20
572 GOTO 628
573 CLS
574 PRINT@20, "TIME CONSTANT"
575 PRINT@35,Q
576 PRINT@133, "FASTER"
5/7 PRINT@153, "SLOWER"
578 PRINT@173, "RETURN"
579 POKE15492,191
580 POKE15532.128
581 FOR X=1TO20
582 NEXT X
583 FOR X=1 TO 50
584 OUT255,00
585 Y=INP(255)
586 IF Y>200 THEN 607
587 NEXT X
588 POKE 15512,191
589 POKE 15492,128
590 FOR X=1 TO 20
591 NEXT X
592 FOR X=1TO50
593 OUT255,00
594 Y=INP(255)
595 IF Y>200 THEN 614
596 NEXT X
597 POKE 15532,191
598 POKE 15512,128
599 FOR X=1 TO 20
600 NEXT X
601 FOR X=1 TO 50
602 OUT255,00
603 Y=INP(255)
604 IF Y>200 THEN 620
605 NEXT X
606 GOTO579
607 Q=(Q-5)
608 IF Q=0 THEN Q=5
609 POKE15492,128
610 PRINT@35,Q
611 FOR X=1 TO 50
612 NEXT X
613 GOTO 579
614 Q=(Q+5)
615 POKE 15512,128
616 PRINT@35,Q
617 FOR X=1 TO 50
618 NEXT X
619 GOTO 579
620 CLS
621 B=0:GOTO7
622 CLS
623 PRINT"1.
                 YOUR PRINTER SHOULD BE ATTACHED AND ON."
624 PRINT"2.
                 REMOVE THE 'AUX' AND 'MIC' PLUGS FROM THE CASSETT
           RECORDER.
                 THE ROOM MUST BE QUIET AND THE RECORDER ON A HARD
625 PRINT"3.
 FLAT
           SURFACE FOR BEST RESULTS.
626 PRINT"4.
                DEPRESS 'RECORD', 'PLAY', AND THE SMALL PIN AS IN
DICATED
           IN THE FLASHING DRAWING."
627 PRINT"5. DEPRESS ANY KEY TO CONTINUE."
628 POKE15916,151:POKE15917,135:POKE15918,131:POKE15919,131:POKE
15920,131:POKE15921,131:POKE15922,131:POKE15923,171:POKE15980,14
9: POKE15987,170
629 POKE16044,149:POKE16045,191:POKE16047,191:POKE16051,170
630 MS=INKEYS
631 IF M$=""THEN633
632 GOTO2
633 POKE15917,131:POKE16045,128:POKE16047,128
634 GOTO 628
```

appear at the bottom of the video screen. The cursor returns to the home position in the upper left and circulates again.

The Space function makes a small block appear on the video display (the printer will print a space). The Print function prints the video display line, and Erase deletes the last character (or space) from the video screen. If you reach the end of the video line (the gap in the indicating bar above the line), the line is automatically printed.

The Speed function produces a new display that has the commands Faster, Slower, and Return. These commands increase or decrease the speed at which the cursor moves. Return sends the program back to the original mode. Anything on the video display line will be lost upon exiting to the Speed control display. You can change the speed as often as you wish.

This program is written in Basic and some delay is allowed after a Print command so the printer noise will not be "heard" by the tape recorder. If your printer is slow, you may want to increase this delay by changing the 500 in line 565 to a greater number, such as 2000.



# JE G SEYO

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## The Color Computer Goes Forth

by Scott L. Norman

\* \* \*

Colorforth Armadillo International Software Austin, TX 78712 Color Computer, 16K \$49.95

 $\star$   $\star$   $\star$   $\star$   $\frac{1}{2}$ 

Starting Forth
Leo Brodie
Prentice-Hall
Englewood Cliffs, NJ 07632
softcover, 348 pp.
\$15.95

by Scott L. Norman

Colorforth is an implementation for the Color Computer's 6809 microprocessor of FIG-Forth, the standard promoted by the Forth Interest Group (FIG) of San Carlos, CA. The documentation is a 12-page Armadillo Software pamphlet and a detailed FIG glossary. The pamphlet contains details on changing the memory maps for disk and cassette systems, as well as a few special features of Colorforth. The FIG publication includes the manual for the source-code text editor.

#### Starting Forth

There's no way a stranger to Forth could learn the language from this material. Armadillo Software suggests you purchase Leo Brodie's book. There are tutorial reviews, problems with solutions, and carefully marked sections for novices and relative experts.

Programming in Forth is now possible for Color Computer owners; read on and find out how

The pages of Starting Forth are inhabited by marvelous cartoon characters who illustrate the functions of Forth words and features: there's a robed monk with a quill pen for the compiler, a hooded medieval executioner for the word execute, and a slick-haired, mustachioed character who constantly refers to his dictionary. Naturally, he's the interpreter. My favorite is the two-headed flying reptile responsible for exchanging the top two numbers on the parameter stack. By an amazing coincidence, the word he represents matches the sound of his wings: swap!

None of this hides the fact that Brodie has produced a serious book. It is best read at the keyboard where you can test the examples interactively, since certain sections are geared to Forth Inc. products and discuss features not relevant to Colorforth. An example is the discussion of the text editor, for which Colorforth uses very different syntax. The FIG notes provide a clear guide to this aspect of the software. In most respects, Starting Forth is excellent in both style and content, and I recommend it.

#### Colorforth

The Colorforth software comes on cassette, with versions for 16K systems with or without disk drives. There are complete instructions for making cassette back-ups and for modifying and

storing disk and cassette versions for 32K systems.

There is also a discussion of the simulated disk screens used by cassette-based systems. Forth uses virtual storage, shuffling 1,024-character screens between disk and RAM as needed. Colorforth reserves RAM for the purpose of simulating such storage units: four of them in 16K, 12 in 32K. (A real disk holds about 135K.)

By using the starting and finishing addresses specified in the documentation, you can store the simulated screens' contents on tape so your newly defined text isn't lost at the end of a terminal session. You can also define new words without using a screen, although you can't use the text editor to correct errors. Words that compile correctly become part of Colorforth's dictionary, at least for the duration of the session. The Colorforth pamphlet also gives the addresses used in saving a dictionary that has been extended.

I added the word CLS to the dictionary, to clear the screen as in Color Basic. Colorforth doesn't have a built-in function like this. My word was constructed as a colon definition; i.e., the defining name, operands, and previously defined (stock) words out of which it was constructed were enclosed between a leading colon and trailing semicolon, like this: : CLS 1024 512 143 FILL; Hitting enter compiles the word into the dictionary.

This illustrates a number of qualities about typical Forth words, so let's take it apart slowly. It starts with the name I choose, which can be up to 31 characters long. The use of long names makes programs somewhat self-documenting, but remember that what's stored is just the first three characters plus a

count of the word's length. This means that WORD1 and WORD2 are indistinguishable as names; both are five characters long and both begin with WOR. It is acceptable to use 1WORD and 2WORD, however.

The definition follows the name of CLS; in this case, "Starting at address 1024, fill 512 memory locations with the byte pattern that translates as decimal number 143." (The definition of the word Fill tells us which operand corresponds to each of these parameters.)

Fill is a general Forth word, and can perform this memory-stuffing operation anywhere in RAM. Recall, however, that in the Color Computer location 1024 is the start of the low-resolution video screen. When you store numbers in such locations, the corresponding graphics character shows up on the video display, so that my Colorforth word is the equivalent of the Color Basic loop:

100 FOR I = 1024 TO 1024 + 511 100 POKE I, 143 120 NEXT I

Referencing Color Computer documentation verifies that here, 143 is a solid green graphics block.

You can see the extent Colorforth represents a customization of Forth to the Color Computer. You can capitalize on the memory-mapped video of the 6809, and use the predefined graphics characters at will.

For example, here is one way to generalize CLS to a new word, YELSCRN, which clears the video display to solid vellow instead of solid green: : YELSCRN 1024 512 159 FILL KEY; Here, 159 represents the solid vellow graphics block denoted as CHR\$(159) in Color Basic. Another stock Forth word, Key, has been introduced. It causes the computer to wait until a key is depressed before continuing (before signifying the complete execution of YELSCRN). The signal takes the form of OK printed on a green field, which spoils the appearance of the solid yellow screen. Thus Key is similar in function to the Basic statement 200 A\$ = INKEY\$ : IF A\$ = "" THEN 200, or to the indefinite loop 200 GOTO 200, often used to freeze a video display.

Once they are defined, invoke the new words by calling them; to clear the screen to green at any time, enter CLS from the keyboard or include it in a program statement.

#### **Text Screen Operations**

You can define a whole series of colored backgrounds if desired. The best way is to use the text editor, entering a whole group of definitions on a screen. Remember, words defined this way don't have to be sequential statements in any one program. When using a disk, prepare the system for screen input by entering "empty-buffers," followed by "disk." The command Editor invokes the editor; screen #1 can then be loaded with blanks and selected for editing by 1 CLEAR.

A text screen consists of 16 lines of a maximum of 64 characters each. The lines are numbered 0-15, and you enter text on line #n by prefixing your material with n P. Thus typing the following two lines loads the defining words for blue and red backgrounds into virtual memory:

2 P: BLUSCRN 1024 512 175 FILL KEY; 3 P: REDSCRN 1024 512 191 FILL KEY;

Line numbers 2 and 3 refer only to locations being edited within the screen; there are no line numbers in a Colorforth program itself.

The last entry on a text screen should be; S (note the lack of a space between semicolon and S), which stops interpretation when the screen is loaded. You need not devote an entire line to this two-character word: Colorforth can handle multiple-word (multiplestatement) lines, as long as they're less than 64 characters. If a single definition is longer than this, press enter when nearing the end of the first 64 characters and continue on the next screen line. A right square bracket, generated by pressing the shift and right arrow keys simultaneously, denotes the start of a continuation line.

The FIG documentation discusses

#### What Forth Is, and Isn't

I knew very little about Forth before being introduced to the Colorforth package, though I had a feeling that it was useful for computer control of machinery. The arrival of the Colorforth cassette motivated me to learn more about the background and capabilities of the language.

I learned that Forth—at least in its original form—was largely the invention of Charles H. Moore, who now heads Forth Inc. in CA. Forth has become a favorite for computer control of instruments among radio astronomers, although since its inception it has found a wider variety of applications.

It's compact, and has been implemented on a range of computers, from mainframes to micros. The microcomputer versions are not necessarily poor relations; a very capable Forth package can be written for a 16K machine.

One of the problems in writing about Forth is that, strictly speaking, it isn't a language, but rather a complete programming environment. A typical package includes a core dictionary of words, a compiler, an assembler, and a text editor for working on source code. For brevity, though, I'll call it a

language in this review. It's easy to customize Forth for any particular application. Most versions, however, start with an unusual degree of commonality. The Forth community has shown a genuine interest in setting standards, which makes it easy to use general texts like Brodie's with other vendors' software packages.

But what is it like to program in Forth? You begin with a dictionary of 150 or so high-level words that act like subroutine calls. These can be added to. In fact, much of what you do when programming in Forth is to define more and more powerful words, combining prior definitions with embedded data. Ultimately, you define a word that, when called, executes the entire program.

Languages implemented in this fashion are said to be threaded; you can visualize a thread of subroutine addresses linking the program words together, eventually ending at the machine-language level where the most basic words (the ones that were in the dictionary to begin with) are defined. The commands a programmer generates can be tested immediately

Continues on p. 82

the text editor. It performs most functions you expect from an editor, although some operations aren't as convenient. For example, it takes two commands to change one text string into another: X oldtext, C newtext.

The word Forth causes the system to leave the editor. All that remains is to compile the words defined on the screen into the dictionary, done easily with the Load command.

#### **Dealing With Numbers**

All the examples so far have used decimal numbers; Colorforth initializes in decimal, just as Basic does. It does have a built-in hexadecimal capability, however, and it's easy to define the system you want and have Colorforth operate in any other base.

You can switch between decimal and hexadecimal with the words Decimal and Hex. These are toggled commands, so exercise a little caution if you change bases in the middle of a routine. Here's a definition for a new word, Convert, which takes a decimal number from the keyboard and prints its hex equivalent: : CONVERT CR HEX. DECIMAL CR; This uses two more predefined words: CR, which generates a carriage return; and ".", the period, which causes the preceding number to print according to the most recently defined base.

You can see how the liberal use of punctuation marks as words makes Forth hard to write about. Assume that you start out in the decimal system; you invoke the new word by entering n Convert, where n is an appropriate number. The entry process puts n on top of the stack. Hex converts the top number on the stack to hexadeci-

mal, the period prints it, and Decimal returns you to base 10 for the next keyboard entry. The initial and final carriage returns provide a decent display.

From this example, you can see how the stack gets involved in Colorforth operations, including I/O.

The next step is the definition of other numbering systems. This involves the predefined variable BASE, which stores the decimal value of the number used for conversions. Here are the definitions of two new systems:

: TERNARY 3 BASE !; : 25-ARY 25 BASE!;

These aren't especially useful, but are different from the Binary and Octal that everyone defines when writing about Forth.

These definitions introduce the ex-

Continued from p. 81

from the keyboard, since they are compiled as they are entered. Alternatively, you can use the text editor to write chunks of source code called blocks or screens. These can be stored on disk or tape, or even in RAM, and entered as a unit.

The Forth incremental compiler also compiles this code as it is entered. Once compiled, new Forth words have the same status as those that came with the original package; there's no difference between the original building blocks and any particular program statement. This lack of a fixed instruction set has caused purists to object to calling Forth a language.

The extendable dictionary is one of Forth's principal features. It takes a little getting used to the fact that the words are not as limited in form as they are in Basic. A Forth word can begin with (or even be) a number. There are even common words that are punctuation marks. It's a little bizarre, but let me get ahead of myself: This is a valid Forth statement, defining one standard word in terms of others: :? @.;

It's true that some of this shorthand makes Forth hard to read. There are a couple things that initially seem strange, at least if you've come through the Basic ranks, and it is worthwhile to mention them before going into the details of Colorforth itself.

The first is the use of a stack. This is a portion of RAM set aside for the sequential storage and retrieval of data in a last-in, first-out (LIFO) fashion. Forth uses the stack, or more properly the parameter stack, to pass operands and data from one word or subroutine to another.

When writing Forth code, it is convenient to keep intermediate results bouncing up and down on the stack from one operation to another. That doesn't mean that you can't name variables and call them as needed; but using the stack intelligently can speed program operation. You can't avoid keeping track of things on the stack anyway, since operands have to be presented to Forth words in the correct order.

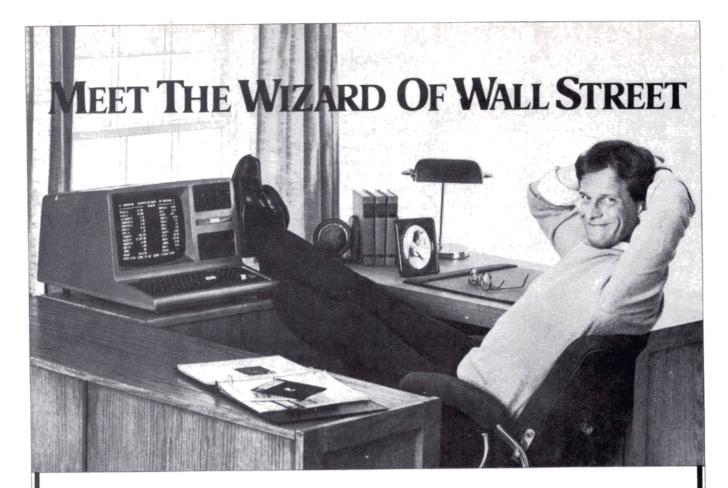
Finally, it can be just plain fun to define your own commands and incorporate them into the dictionary; it's the easiest way I know to produce your own personalized computer language.

Forth uses a second (or return) stack to keep track of procedure call information. Programmers use the return stack to test the current value of the running index in a DO loop, Forth's equivalent of the For...Next loop.

Because of the parameter stack, Forth employs reverse Polish, or postfix, notation (RPN). In this system, arithmetic expressions are written with operations following the operands to which they apply, so that A + B \* (C-D) / E becomes CD-B \* E / A +. Operations are carried out immediately as the expression scans from left to right. No parentheses are needed, and there is no implied hierarchy of mathematical operations. Compilation or interpretation can be very fast.

Hewlett-Packard calculator users will recognize this, as their machines use RPN. In fact, Forthlike languages are used in the ROMs of some calculators, as well as in scientific instruments, machine-tool controllers, and so on. Still, before plunging into the Colorforth version, ask what Forth can do for a microcomputer owner, especially a Color Computer owner. After all, it requires a lot of attention to detail, the necessity to move numbers to and from the stack makes it less than ideal for number crunching, and its structure and syntax are radically different from those of Color Basic.

To some extent, this difference is responsible for some of Forth's appeal. It allows the programmer close control over the computer (for I/O operations, for example) that you associate with Assembly language, but it's easier to work with. It's fast, and it's easy to incorporate Assembly-language subroutines into a Forth program for the most time-critical applications.



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clamation point, which Forth uses to denote storing a number at a specified address. The syntax is such that you provide the address by specifying the variable BASE; variables return their addresses to the stack, while constants return their values.

Earlier, I referred to a number n as an "appropriate" number. What does this mean? Colorforth is set up to do fixed-point arithmetic only, using signed 16-bit numbers (32767 to -32768). This is a general property of Forth, even when used on 8-bit microprocessors. Some double-length operations are available, and it's possible to write floating-point routines, but this is one reason Colorforth wouldn't be the language of choice for scientific number crunching.

To enter a double-length number, you punctuate it with a period; you can enter 100000 as 100.000, for example. Colorforth also has formatting commands similar to Print Using for outputting large numbers.

Although the range of numbers usable for calculation is limited, some operators do interpret 16 bits as an unsigned number (0-65536). As you'll see, this is what you need to address memory-mapped I/O in the Color Computer.

#### **Comparison and Control Structures**

Colorforth has a fairly complete set of comparison operators, which are used to control program branching within If...Then...Else statements. Because of RPN, the syntax of these commands takes some getting used to, although the ideas are familiar enough from Basic. Here are Color Basic and Colorforth program fragments that accept a number from the keyboard, test it to see if it is positive or negative, and print the result:

Color Basic 100 INPUT N 110 IF N > 0 THEN PRINT "POSITIVE" ELSE PRINT "NEGATIVE"

Colorforth: TEST 0 > IF . " POSITIVE "
ELSE . " NEGATIVE " THEN; (Used by entering N TEST)

Notice that in Colorforth, the words If and Then span the possible branches the program might take, but not the decision-making portion. That comes before the If, in the form required by RPN; for example, (N > 0) becomes (N 0>), where, in my example, N is put on the stack from the keyboard. This example also introduces dot-quote, the word used to print literals. Neither ex-

ample considers the possibility that N equals zero.

In the Basic example, control passes to the statement following line 110 after a message has been printed. Similarly, Colorforth passes to whatever follows Then. There is a difference, of course, in that the Basic If...Then could have altered program flow by using statement numbers (implied GOTOs), instead of the Print commands. Because Colorforth is a structured language without line numbers, there are no GOTO statements. You can use other words within the If...Then to execute actions other than printing, however. After they are executed, control eventually returns to the word following Then.

"Colorforth has a fairly complete set of comparison operators, which are used to control program branching within If...Then...
Else statements."

Colorforth comparison expressions can be quite lengthy, as they are in Basic. Simple algebraic comparisons can be logically combined, using AND, OR, or XOR operators.

Color Basic has only one kind of repetitive structure, the definite For...Next loop where the index's lower and upper bounds are specified. Colorforth has a similar construct, called a DO loop, plus a pair of indefinite forms, the Begin...Until and Begin...While...Repeat loops. The DO loop cannot be executed interactively; it must be compiled into a word. although you can specify one or both limits from the keyboard when the word is executed. Typical syntax is: : TEST b a DO (expression) LOOP; where the loop index will run from a to (b-1).

For this example, b must be greater than a, and the index is incremented by one for each pass through the loop; the more general form is: NEWTEST b a DO (expression) c + LOOP;, where c is the step size, which can be negative, and where the loop is terminated by the

word + LOOP.

The current value of the loop index is always kept on the second (return) stack, from which it can be obtained by the Colorforth word I. Here's a simple example that loops 10 times, printing the number of each cycle as it goes along: : COUNT 11 1 DO CR I . LOOP:

Loops can also be nested. Here is a pair that together make a software timer: : TIMER 0 DO 15500 0 DO LOOP LOOP;. To time out N seconds, enter N TIMER. N serves as the upper limit for the outer loop, while the inner loop does nothing 15,500 times per second. This gives you an idea of Colorforth's relative speed. Color Basic's For...Next timing loop only executes 460 times per second. Notice that each nested loop terminates on its own Loop, in contrast to Basic, where loops can share a Next statement.

The indefinite loops have no simple counterparts in Basic, although Pascal and other structured languages have similar constructs. These loops are used to repeat some action or calculation until a particular event occurs, where the programmer has no control over how long that might take. The general syntax for a Begin...Until loop is: BEGIN (expression to be repeated) f UNTIL, where f represents a logical flag. The main expression is repeated as long as the flag is zero (false). The loop ends when the flag takes on the value one (true). Mathematical comparisons such as N > 1 return flags of this sort to the top of the stack.

The inverse behavior, the repetition of an operation as long as something is true rather than until it is true, is obtained with the Begin...While...Repeat loop, where the logical test is performed part way through the cycle. The construction is: BEGIN (first part) f WHILE (second part) REPEAT. After the first part of the computation, the program tests a flag. If it is true, execution continues to the second part of the computation and the whole thing repeats. As soon as the flag tests false, execution exits from the loop.

#### Constants, Variables, and Arrays

Although Colorforth uses the stack for temporary storage, it also lets you name constants and variables for future reference. The naming phrases are: VARIABLE (name) and (value) CONSTANT (name). These phrases are not colon definitions, like those I used for CLS. It is not necessary to specify the functions of Variable

and Constant; they're predefined words, and their machine code takes care of that.

Earlier, I said that using the name of a variable in another statement puts that variable's address on top of the stack. If you use the name of a constant, its value, not its address, is placed there.

Look again at the word YELSCRN. You can define the solid yellow graphics block this way: 159 CONSTANT YELBLOCK, so the word that sets the screen to a solid vellow becomes: : YELSCRN 1024 512 YELBLOCK FILL KEY;. This isn't very profound, but it's a necessity for high-level languages. Even Assembly language lets you use labels.

If using a variable's name returns its address, how do you get its value? For that matter, how do you set its value? As you might expect, Forth dialects have other words for storing and retrieving the variables' values. The bad news is that these particular words use punctuation marks, so they are difficult to write about clearly, and their forms don't necessarily suggest their definitions. Still, Color Basic programmers get used to a leading question mark for Print and an apostrophe for REM.

The word that stores a 16-bit number at any given address is an exclamation point. So, the definition of TER-NARY, "3 BASE!" actually consists of the phrase, "Store the 16-bit representation of the decimal number 3 in the address referred to by the predefined variable BASE." There is another word, "+!", that adds a number to whatever is at a given address, similar to the add-to-memory key on a calculator.

The operation of retrieving the value from a particular address and putting it on the stack is performed by the at symbol (@), pronounced fetch. A useful extension, symbolized by the question mark, is fetch followed by a print command. The operand precedes this word; to find out what number system Colorforth is in at any time, enter DECIMAL BASE?. A little thought shows you why the word Decimal is needed. The definition of the word "?" is the cryptic example I gave in the section "What Forth Is."

These words are useful to Forth programs running on 16-bit machines, although they also exist in the Colorforth dictionary. There are analogous words, C! and C@, that store and fetch 8-bit values and are more interesting to Color Computer programmers. The C prefix stands for character, because these words are useful for manipulating ASCII characters (even on larger machines).

Here's a routine that exercises some of the concepts and Colorforth words I've introduced so far. It displays each of the Color Computer's 256 distinct printable characters, including graphics blocks, in turn at the middle of the screen (location 1295). Each character shows on the screen for two seconds.

> 1295 CONSTANT MIDSCRN : CHARS CLS 256 0 DO I MIDSCRN C! 2 TIMER LOOP;

C! acts like POKE, rather than PRINT CHR\$, as far as video memory goes; the table on page 211 of the June 1981 80 Micro spells out the differences.

Forth dialects also support array definitions. These are treated as variables with extended memory areas set aside for the data values' storage. The equivalent of Basic's DIM statement is the word Allot, used this way: VARI-ABLE (array name) (n) ALLOT. where n is the number of bytes of storage reserved, in addition to the two bytes that are automatically set aside by the word Variable. Remember, even Colorforth assumes you're working with 16-bit numbers unless otherwise

HEX (Square Wave Sound)

1 FF01 CONSTANT AD1

2 FF03 CONSTANT AD2

FF23 CONSTANT AD3 3

FF20 CONSTANT D/A

: 1SEL AD1 C@ F7 AND AD1 C!; (Puts 0 in bit 3 of \$FF01)

: 2SEL AD2 C@ F7 AND AD2 C! :

: SNDENABLE AD3 C@ 8 OR AD3 C!; (Puts 1 in bit 3 of \$FF23)

: TIME F 0 DO LOOP; (Approx. 0.001 sec. delay)

: SOUNDOFF HEX ISEL 2SEL SNDENABLE BEGIN FC D/A C! TIME

10 ] 0 D/A C! TIME 0 UNTIL; (Infinite loop)

Figure 1



due to our description of the game!

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informed. So to set up a 10-member array named Info filled with 16-bit numbers, specify an additional  $(9 \times 2)$  bytes: VARIABLE INFO 18 ALLOT.

If you use an array for 8-bit numbers such as graphics or ASCII codes, you can cut down on the amount of memory you must reserve. Variable gives you space for the first two numbers, and you just specify one byte for every additional storage position.

Storing data in an array or retrieving it is more complicated than in Basic, because Colorforth doesn't support subscripted variables. You specify the first storage location by using the array name (it's a variable, remember), and then add an offset to get to the desired location. For example, you can locate the first cell (the Forth name for a 16-bit-wide storage location) in our array Info just by calling Info; offset the Nth cell by 2x (N-1) bytes, so you can find out what's in, say, the fifth cell with the phrase INFO 8 + ?.

Of course, if you use an array for 8-bit numbers, there's no need to double the subscript N to get the offset. You must use the store and fetch commands—! and @, C! and C@—appropriate to the length of the numbers you are working with; Colorforth has no other way of knowing.

Colorforth can also handle multidimensional arrays. You must decide on a convenient method for converting multiple subscripts to single address offsets. Brodie's book gives a nice example for two-dimensional arrays, which wind up being stored columnwise. All the elements of the first column, starting with the uppermost, are stored, then all the elements of the second column, and so on. This is actually the way many high-level languages treat such data structures.

#### Something Completely Different

Here are a couple examples of the way you can use Colorforth with the Color Computer's I/O structure.

Anyone who has used the Color Computer's joysticks knows about memory address 65280, which is PEEKed to test the status of the trigger buttons. You can give this address a name, such as Port: 65280 CONSTANT PORT. Colorforth interprets this properly (the internal representation is treated as an unsigned 16-bit number). The word Looksee prints the contents of this location:: LOOKSEE 2 TIMER PORT C@ .;.

Entering Looksee from the keyboard causes the system to wait two seconds (assuming the previous definition of Timer, of course) and then prints the contents—255 or 127 if you press neither joystick trigger, 254 or 126 for the right trigger, and so on. Since a single memory location can only contain an 8-bit number, the proper fetch command is C@. It is easy to incorporate Looksee into an If... Then statement, causing a program branch, rather than having it print and stop.

While Port is a constant whose value is put on the stack when used in another word, there's nothing wrong with this value representing the address of something else. Remember, if Port is defined as a variable, its address is put on the stack, not the address of the trigger-button sensor.

The final example uses this sort of labeling, and is less trivial: a sound generator. This program generates a square wave at approximately 500 Hz and routes it to the Color Computer's composite video output. If you are interested in this sort of thing, you need detailed reference material. I recommend the Radio Shack reference or service manuals, or the *Facts* book from Spectral Associates. In any event, here's a rundown on the relevant aspects of Color Computer operation.

Internally synthesized sound uses the Color Computer's D/A converter. To be specific, a six-bit number loaded into the six high-order positions of address \$FF20 is converted into analog voltage—the larger the binary number, the larger the voltage. The D/A is also used for joystick input and for the cassette interface.

To ensure that signals are routed properly, a few addresses associated with the computer's peripheral interface adapter (PIA) circuits have to be properly programmed (\$FF20 also belongs to a PIA). Briefly, you need zeros in bit 3 of \$FF01 and \$FF03 (analog multiplexer), and a one in bit 3 of \$FF23 (six-bit sound enable). To set 1 bit at an address, logically AND or OR the address's contents with an appropriate binary mask, and the program takes care of that. Then you need a loop to load those six bits of D/A input at an audio rate.

The Program Listing has the line numbers you might see if you composed it on a screen. (The parenthetical expressions are Forth's version of REM statements; they can appear anywhere, even within another statement.)

Line 0 tells the Colorforth interpreter that hex numbers are coming in at compilation time. Lines 1-4 label the addresses of interest to us, in hex. Lines 5-7 each fetch an eight-bit

number from one of the locations, set bit 3 to what you need for sound output, and store the new number in the old number's location. The mnemonics represent select 1, select 2, and sound enable. You can verify that ANDing and ORing with these operands affects only bit 3 of the appropriate word. Just remember that the rightmost position is bit 0.

Line 8 defines a one-millisecond timing loop, with the upper limit in hex. Lines 9 and 10 contain the definition of Soundoff, which is the whole program. Two screen lines were used because of the definition's length. The square bracket that begins line 10 signals the interpreter that this is a continuation. Finally, line 11 contains the word that terminates compilation when the screen is loaded.

A few things about the colon definition of Soundoff: The definition includes hex so that it works properly even if called when the system has been operating in another base. Then it calls the words that set the software latches for sound output and enters an infinite Begin...Until loop. (The loop is guaranteed infinite because the logical flag tested to terminate the loop is defined to be 0, rather than being set as the result of any other process.)

The operations within the loop consist of setting the six high-order bits of \$FF20 to ones and zeros, holding each setting for about one millisecond. The reason that you use \$FC, and not \$FF, for the high value is that the two low-order bits of this address are held at zero when you use the D/A in the six-bit sound output mode. ANDing and ORing are used to set \$FF20.

#### Summary

Colorforth may seem complex when compared with Color Basic, but it's closer to Assembly language in the level of detail required. Remember, with Colorforth you get a higher degree of control over machine operations than Basic offers, coupled with high speed. I have not covered text manipulation, but the words for sophisticated text I/O are present in the starting vocabulary. This is where I should encourage you to get the software and the book and find out for yourselves.

Just one more thing: You can apply the bit twiddling used in the definition of Soundoff to program the SAM and VDG circuits for graphics.

Scott Norman lives at 8 Doris Road, Framingham, MA 01701.

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## The Calculating Genius—Part II

by Rick Cook

harles Babbage's Analytical Engine was the ancestor of the modern computer. It was designed to run with punched-card control.

Ed. note: This is the second of a twopart series on Charles Babbage, inventor of the modern-day computer. The first part covered the development of the Difference Engine. This part focuses on the Analytical Engine.

From 1834 on, Babbage's main concern was his Analytical Engine, a mechanical digital computer capable of performing elaborate mathematical analysis more or less automatically.

The idea of the Analytical Engine seems to have taken firm hold in 1833 when he took the small calculating device he had built from parts of the Difference Engine and hooked it up to feed the number appearing in the result column back into the machine as a difference, calculating a whole new series.

By the 1830s, mechanical methods of doing arithmetic had been known for a long time. Since multiplication can be accomplished by repeated additions, and division is the inverse of multiplication, theoretically any machine that could add could be made to do the other operations as well. But Babbage was looking for something more sophisticated. He wanted a machine that

could perform these operations on large numbers at reasonable speed with a minimum of human intervention.

Babbage realized the major problem with this conception was not arithmetic, but control. The earlier machines had shown ways to handle arithmetic and the Difference Engine showed how to store numbers, but no one had ever tackled the control problem. To be useful, the machine would have to be able to perform operations in whatever sequence might be appropriate to the problem at hand.

The solution lay in two things: the use of punched cards to supply data and instructions and the use of a chain—a mechanical AND circuit.

Punched-card control was familiar to Babbage from the Jacquard looms that were busy by the hundreds in Europe weaving elaborate textiles. Jacquard hadn't invented the punched-card loom, but he had come up with a way of feeding cards into the loom so that a large number of cards could be used to control the pattern. By 1835 the French were using steam-powered Jacquard looms to weave very fine tapestries. On his travels, Babbage acquired

a portrait of Jacquard woven to such size and complexity that it took 24,000 cards to program the loom.

The essence of Babbage's chain was the same as the plug boards that were used to program the earliest electronic computers. The Analytical Engine was actually a mass of separate mechanisms that could be coupled or uncoupled at the command of the instruction cards. Only those parts needed for a particular instruction would be coupled at any one time.

Since the machine was completely modular, wear and waste motion were held to a minimum. The mass in motion at any instant would be low and the chains of driven parts would be short. What's more, the Analytical Engine could be built and tested a piece at a time, and a component that failed could be taken out of service without shutting down the rest of the machine.

Clearly, Babbage had learned from his experiences with the Difference Engine. But in the end flexibility was a mixed blessing since it encouraged Babbage to keep tinkering with the design for the rest of his life. Babbage kept adding new features to enlarge its capacity, even though the basic outline was fixed by about 1840.

If the Analytical Engine had ever been built, it would have been even more impressive than the Difference Engine. Babbage's ultimate design called for it to be able to store 1,000 50-digit signed numbers, each in a column of disks like those used for the

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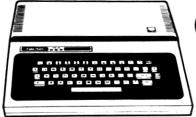
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Difference Engine. Numbers would be read into and out of memory by rack-and-pinion gears. The memory area was called the store and the collection of mechanisms that did the computing was called the mill.

#### **Programming the Analytical Engine**

The machine was programmed with three sets of punched cards. Each set was tied together to form a chain that could be pulled through the machine in the manner of the cards controlling a Jacquard loom. The machine could move the cards back and forth through the reader so that a set of instructions could be repeated—the equivalent of a Do... Until statement.

The first set of cards, the number cards, contained the data to be acted on. The second set, the operations cards, directed the operations to be performed. The third set, the directive cards, told the machine where to store the numbers and where to store the results. In effect, they acted like the stack register in a microprocessor.

Programming the Analytical Engine was done the same way a machine-language program is written today. Memory was at a premium, so a high-level language like Basic was out of the question. On the other hand, the speeds for reading a card and reading a number from memory were roughly comparable, so the distinction we make between main and auxiliary memory didn't exist.

This makes it hard to compare the Analytical Engine's storage capacity meaningfully with a modern computer. The memory locations probably would have only been used for intermediate results in calculations. The data being operated on would not have been read into memory first.

When it came to operation, the machine was not as automatic as a modern computer. A number of cases required the operator's intervention. The Analytical Engine would not normally calculate trig functions in the course of a program. Instead, it would signal the operator what it needed. The operator would take the card bearing the needed function out of the precalculated library and feed it into the machine. The engine would verify that the card it had been given was the right one and then go on with its calculations.

The machine also had a provision for indicating a variety of errors, including overflow and underflow.

On the whole, the Analytical Engine would probably have been about as flexible and powerful as such first-gen-

eration machines as ENIAC, although very much slower.

#### The Later Years

After his experiences with the Difference Engine, Babbage was not inclined to go to the government for money again. He told the government what he was up to, but the officials responded scathingly to what they considered another request for money. For the rest of his life Babbage bore a grudge against officialdom. He went ahead with the work at his home in London, concentrating on perfecting the design and only building those

"Time and again
Babbage was balked
by bad
management practices."

parts he needed to make sure they would work.

In 1842, L.F. Menabrea, an Italian mathematician and engineer, published an article in a Swiss magazine describing the Analytical Engine and how it worked. Babbage had talked to Menabrea about the engine when he went to Italy in 1839. In 1842 the paper was translated into English by Ada Agusta, Countess Lovelace, another friend of Babbage's and a considerable mathematical talent in her own right. With Babbage's encouragement, she prepared a series of extensive notes on the Analytical Engine which she attached to Menabrea's paper. Those notes included a description of machine-language programming that can still serve as a nontechnical introduction to the subject.

The paper and the generally positive reaction to it were the closest things Babbage got to support for his work. Once again there was wide admiration for his genius, but this was tempered by a near-total lack of comprehension of what the Analytical Engine was and how it would operate. For every General Menabrea or Lady Lovelace, a hundred scientists or mathematicians found the Analytical Engine foolish, impossible or merely incomprehensible.

This was especially true in England. On the Continent and in the United States, Babbage's stock stood considerably higher. In his later years, Babbage received and cher-

ished many letters from Americans, including requests from the U.S. Government for advice on cryptography and calculating machines.

Babbage kept himself busy with many projects besides the Analytical Engine. At one point he conceived the idea of building a machine to play tictac-toe and exhibiting it to raise money to finance the Analytical Engine. He got as far as outlining the basic rules for teaching a machine to play any game and devising a tic-tac-toe strategy based on the magic square before he discovered that the public preferred General Tom Thumb to even the cleverest automata. In addition, he invented an occulting light for lighthouses, the opthalmoscope, published a book on ciphers, papers on statistics and geology, and pamphlets advocating life peerages and the income tax.

However, as time went on his life tended to become more and more circumscribed. His friends died off and the bitterness he felt over his disappointments deepened. Still he labored over his Analytical Engine, refining and redesigning it, although he knew by now it would probably never be built.

In his book on the history of computing, Herman H. Goldstine quotes Lord Moulton recounting a visit to Babbage in his last years:

"One of the sad memories of my life is a visit to the celebrated mathematician and inventor, Mr. Babbage. He was far advanced in age but his mind was still as vigorous as ever. He took me through his workroom. In the first room I saw parts of his original Calculating Engine [the Difference Engine], which had been shown in an incomplete state many years before and had even been put to some use. I asked him about its present form.

"I have not finished it because in working at it, I came on the idea of my Analytical Engine, which would do all that it was capable of doing and much more. Indeed, the idea was so much simpler that it would have taken more work to complete the Calculating Machine than to design and construct the other in its entirety, so I turned my attention to the Analytical Machine.' I asked if I could see it. 'I have never completed it,' he said, 'because I have hit upon a different and far more effective method and this rendered it useless to proceed on the old lines.' Then we went into the third room. There lay scattered bits of mechanism, but I saw no trace of any working machine. Very cautiously I approached the subject and received the dreaded answer. 'It is not constructed yet, but I am working on it and it will take less time to construct it altogether than it would to complete the Analytical Machine in the state that I left it.'

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"I took my leave of the old man with a heavy heart. When he died a few years later, not only had he constructed no machine, but the verdict of a jury of kind and sympathetic scientific men who were deputed to pronounce upon what he had left behind him, either in papers or in mechanism, was that it was too incomplete to be capable of being put to any useful purpose."

Lord Moulton's last statement is somewhat inaccurate. Seven years after Babbage's death, the Royal Society appointed a committee to look at the Analytical Engine and decide whether it should be completed. The committee reported that all, or almost all, of the basic design work was done, but the cost of translating the design to working drawings and actually building the machine would be enormous. For this reason the committee recommended letting the Analytical Engine lie.

Charles Babbage died on October 18, 1871, at the age of 79 without ever seeing an Analytical Engine. After his death, his son, Henry, published a book on the engines that included many Analytical Engine details. Henry also commissioned the building of the Analytical Engine's mill and presented it to the Science Museum in London.

Probably the best epitaph that Charles Babbage could have comes from his autobiography, *Passages in the Life of a Philosopher*, written in 1864:

"The great principles on which the Analytical Engine rests have been examined, admitted, recorded, and demonstrated. The mechanism has now been reduced to unexpected simplicity. Half a century may elapse before anyone without these aids, which I leave behind me, will attempt so unpromising a task. If, unwarned by my example, any man should undertake and shall succeed in really constructing an engine embodying in itself the whole of the executive department of mathematical analysis upon different principles or by simpler mechanical means, I have no fear of leaving my reputation in his charge, for he alone will be fully able to appreciate the nature of my efforts and the value of their results."

#### The Final Questions

In any event, it was nearly 70 years after Charles Babbage's death before his dreams were to be realized. In response to the need for new kinds of tables—firing tables for artillery—other men built machines like the one he had envisioned. These new analytical engines were far faster than Babbage's and used electronics rather than mechanics, but the first generation was remarkably similar in size and general structure to what Bab-

bage had tried to build.

With the invention of these machines, Babbage was lifted out of obscurity and his memory honored for his ideas and attempts.

But still the questions remain. Could his calculating machines have worked? If so, why did Babbage fail?

The usual answer is that they could not have worked. Babbage was too far ahead of his time; the materials and techniques for shaping the parts weren't available; the designs were too complex. Yet the evidence doesn't support any of these conclusions.

Granted that the machines were complex and that Babbage was pushing the state of the art, but the designs were exceedingly clever and Babbage took great pains to see that they could be manufactured and would function in spite of their complexity.

Certainly the Difference Engine should have worked. By the time work stopped, all the technical problems had been solved and its complexity was the complexity of a single, fairly simple assembly repeated many times over.

The Analytical Engine is not as certain since it was more complicated and never got beyond the design stage. Still, it displays the same ingenuity of design and attention to reliability that marked the Difference Engine. In addition, the Analytical Engine was actually a collection of separate mechanisms that only joined to become a larger mechanism on command. Given the modular principles on which it was designed, it should have been possible to build a basic Analytical Engine out of the best-proved various mechanisms and then modify it as the more elaborate and troublesome parts were built and tested. This is essentially the way ENIAC and a great many homebrew microcomputer systems were built.

Then, if the machines could have been constructed and if they would have worked, why did Babbage fail? I think the answer lies in what he could not invent.

Babbage pioneered in cybernetic theory, machine and tool design, operations research, and a number of other engineering fields. But he was less advanced than many of his contemporaries in what we now know as project engineering. It was this lack that doomed his efforts. Babbage was capable of inventing the machines, but he could not invent the procedures needed to make their construction go smoothly.

Time and again, Babbage was balked by bad management practices. His failure to get the original agreement with the government in writing, his failure to set up an adequate system of progress payments, his inability to realistically estimate costs and construction times, his failure to secure ownership of crucial tools and fixtures, and his inability to stop designing and get on with the building all contributed to the failure of his projects.

To us these procedures are as commonplace as the idea of a digital computer. To Babbage and his contemporaries, both concepts were blindingly original. It was the genius of Charles Babbage that he was able to grasp one idea and his downfall that he did not understand the other.

Rick Cook can be reached at Box 15193, Phoenix, AZ 85060.

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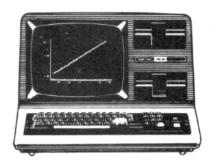
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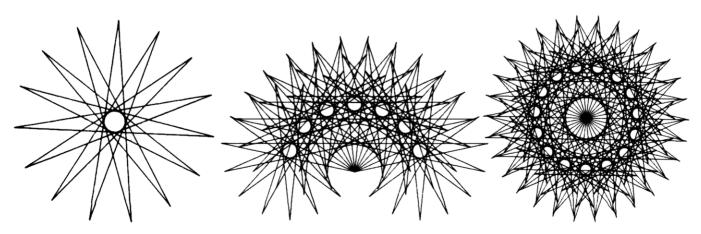


Fig. 1. Stages in the construction of the design with K = 15 and J = 6

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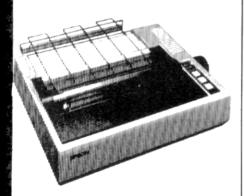
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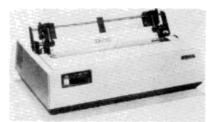
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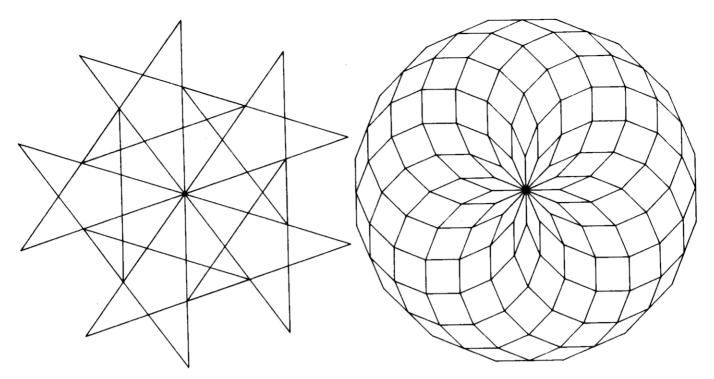


Fig. 2. K = 5 and J = 1

Fig. 3. K = 16 and J = 0

ning sum. Successive values of this sum are multiplied by a scaling factor and connected by a line on the screen which represents the complex plane. The root added at each stage depends on the J value. The sequence of pictures in Fig. 1 show stages in plotting the design with K equals 15 and J equals 6. The final graph is 15 copies of the first, each with the center rotated at an angle of 24 degrees (= 360/15). The calculation of the scaling factor is the only difficult mathematics involved, which is necessary so the pattern fills the screen for any value

of the parameters. For a more detailed discussion of the mathematics involved see "Picturesque Exponential Sums, I" by D. H. and Emma Lehmer in the November 1979 issue of the American Mathematical Monthly.

Another very striking pattern can be formed with this program. I call these medallions; the effect depends on the eye's ability to pick out regularity from complex data. If K is large, say  $60 \le K \le 400$ , and J equals (K-2)/2, then a series of equally spaced rays from center screen outward are formed. These rays are actually stair

steps. The eye organizes the steps from adjacent lines into curves. Use the program to experiment and find other patterns. The program organization is parallel to the description given in paragraph two. I added spaces and comments to make the structure clear. Copy the print statements exactly to avoid split words. The A\$ equals IN-KEY\$ at line 3050 allows you to temporarily stop execution using Shift@ without omitting the pause after construction of the design in menu option three. At line 10030 a procedure for calculating the greatest com-

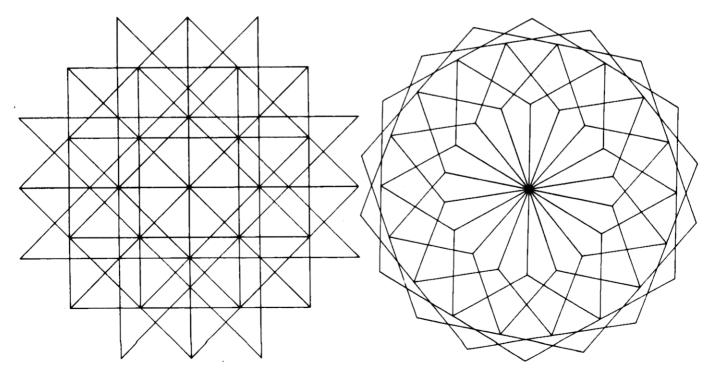


Fig. 4. K = 8 and J = 2

Fig. 5. K = 18 and J = 2

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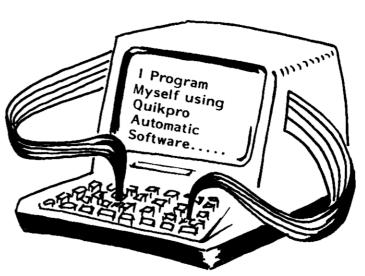
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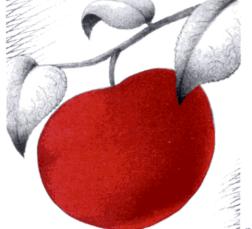


mon divisor of integers TK and TJ is used in the scaling mentioned above and to avoid retracing lines. The examples in Figs. 1-5 were done on an HP7225A plotter, but Extended Basic Color Computer's PMODE4 resolution (256 by 192) gives a clean display for reasonable values of K and J.■

Sidney Garrison is employed by Texas A&M University.

```
100 ** * * * * * * * * * * * *
110 'FLAKY BY S.GARRISON 12/81 120 '* * * * * * * * * * * * * * * *
 130 PI=3.14159265
                                                                       : HALF=.5
     : HH=95
                                                                       : HW=128
        UNIT=1
 200 ' GREETING * * * * * * * *
 210 DATA 15,1,5,0,7,2,16,0,200,
                                                                           99,8,2,5,1,13,5,8,0,9,1,6,0,
         120,39,9,3
 220 UL=RND(12)
 230 FOR I=1 TO UL
                                                                       : READ K.J
     : NEXT I
 240 READ K,J
                                                                       : GOSUB 10000
        GOSUB 10500
                                                                       : RESTORE
 300
        " MENU * * * * * * * *
 310 CLS
 320 PRINT@39, "FLAKY: SNOW FLAKES"
330 PRINTEGS, TELESCOPE VALUES OF K AND J THE CONTROL OF THE CONTR
                                    GIVEN PROPER VALUES OF K AND J THE COMPUTER PLO
                       1.AUTOMATIC-A FEW NICE VALUES. 2.AUTOMATIC-SHOWS AL
L FLAKES.
                         3.MANUAL-YOU PICK K AND J.
                                                                                            4.END PROGRAM."
 350 PRINT"HIT 1,2,3 OR 4."
360 A$=INKEY$
                                                                       : IF A$="" THEN 360
: IF V*(5-V)<1 THEN 300
370 V=VAL(A$)
380 ON V GOSUB 1000,2000,3000,
390 GOTO 300
                                                                            4000
 1000 ' A FEW NICE FLAKES * * * *
1010 FOR N=1 TO 13
                                                                       : READ K,J
     : GOSUB 10000
                                                                       : GOSUB 10500
     : NEXT N
1020 RESTORE
2000 ' SHOWS ALL FLAKES * * * *
                                                                       : RETURN
2010 K=3
 2020 FOR J=0 TO (K-2)/2
                                                                       : GOSUB 10000
     : GOSUB 10500
                                                                       : NEXT J
2030 K=K+1
                                                                       : GOTO 2020
3000 ' PICK YOUR DESIGN * * * *
3010 CLS
                                                                       : PRINT
3020 INPUT"
                             INPUT PARAMETERS K (INTEGER K>2) AND J (INTEGER Ø
 <=2J<=K-2). ";K,J
3030 CLS
                                                                       ; IF INT(K) <>K OR INT(J) <> J OR
        K<3 OR J<0 OR J>(K-2)/2 THEN
                                                                          PRINT
     : PRINT "ILLEGAL K OR J, READ DIRECTIONS"
    : PRINT
                                                                       : GOTO 3020
3040 GOSUB 10000
3050 A$=INKEY$
3060 AS=INKEYS
                                                                       : IF AS="" THEN 3060
3070 RETURN
4000 END
10000 'SUBROUTINE PLOT * * * *
                                                                        INPUT: LEGAL K,J
    OUTPUT: GRAPH
10010 ASTEP=2*PI/K
                                                                       : BSTEP=ASTEP*(J+1)
10020 S=1/SIN(PI*(J+1)/K)
     : TJ=J+1 '* S=SCALE FACTOR* *
10030 TK=TK-INT(TK/TJ)*TJ
                                                                       : IF ABS(TK)>HALF THEN TT=TJ
    : TJ=TK
                                                                       : TK=TT
       GOTO 10030 '* TJ=(K,J+1)* *
10040 TJ=INT(TJ+HALF)
                                                                       : TK=K/TJ
     : IF TK-INT(TK/2)*2 > HALF
                                                                          THEN S=S*COS(PI*TJ/(2*K))
10050 UI=K+HALF
                                                                       : UL=TK-HALF
10060 PMODE4,1
                                                                       : PCLS
    : SCREEN1,1
                                                                       : 'INTIALIZE SCREEN * * * * *
10070 ' DRAW !! * * * * * * *
10080 FOR I=UNIT TO UI
                                                                       : CH=ZERO
     : CV=ZERO
                                                                       : A=(I-1) *ASTEP
10090 FOR L=UNIT TO UL
                                                                          CH=CH+COS(A)/S
    : CV=CV+SIN(A)/S
                                                                       : LINE - (HW+INT(HH*CH+HALF),
        HH+INT(HH*CV+HALF)), PSET
                                                                       : A=A+BSTEP
    : NEXT L
10100 LINE -(HW, HH), PSET
10110 RETURN
10500 ' DELAY
                              * * * * * * * *
10510 FOR I=1 TO 800
                                                                       : NEXT I
    : RETURN
```

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## Bit Smitten—Part V

by Jay Chidsey

his month Jay Chidsey shows you how to gain access to string data for use in programs which require random selection of words.

This month I will discuss the array capabilities of TRS-80 Level II Basic with particular attention to gaining random access to string data for use in something like a poetry generating program. Many game programs require similar random selection of words or phrases out of a large number of words contained in data statements.

Arrays are very easy to use, once you understand what they are and how they work.

An array is an ordered series or arrangement of alphanumeric (alphabetic and numeric) items presented in a logically related and useful pattern.

The simplest kind of array is one dimensional; it's a list of items. A one-dimensional array is called a vector. A list can be as long as you want and have need for (and have memory space to accommodate), and it can be made up of either words or numbers.

An array can also be multi-dimensional. If, for example, you were the franchise holder on five McDonald's or Mister Donut or Frostee Freeze places, you might want to keep a record of 12 different categories of expenses for each of the five locations. Such a two-dimensional (or any multi-dimensional) representation is called a matrix or a table.

If you kept such records every day, then the day of the month could be a third dimension, the month (1-12) might be a fourth, and the year (82, 83 and so on) might be a fifth dimension. This would form a five-dimensional matrix in which each expense item entry was uniquely tagged, and recoverable from your data files through appropriate programmed inquiry. Item A(4,2,

17,9,2), for example, would be the fourth expense item listed for location two on the 17th day of the ninth month (September) in 1982.

Level II Basic's array capability makes it possible to take information out of dead storage and put it into dynamic and usable memory. The information put into an array might come from input statements contained in your program, but most commonly it will come from data statements. I will deal only with data storage in this month's column. I will show you how to get words out of storage in data lines and into memory for manipulation and use. I'll use a scaled-down version of my poetry generating program (see the listing) as an example.

It's useful to think of the data in your TRS-80 as a huge high stack of information, with the first data entry as the item on the very top of that stack, and the last item in the last data line as the one on the very bottom of the stack. When you read that data into memory, the item at the top of the stack is read first, and assigned to the variable you name following the Read command. In this case, the variables to be subscripted are N, V, and A; N(1), N(2) and so on.

If you want to read down only so far, or to find a particular item and stop there, you can then insert the Restore command into your program, and the next Read will begin at the very top of the stack again. You can't start over part way down the stack, but you can start again at the top and peel off the data you want to discard quite simply.

In this poetry program I want to read three categories of words: nouns, verbs and adjectives. I will then randomly select among those words to construct poems.

#### Notes on the Program

In a program that uses words rather than numbers in its data lines, you must first clear space for string variables. This is done at line 90 with a CLEAR 10000. If no number of bytes are cleared by such a statement, the TRS-80 defaults to an automatic Clear of 50 bytes. If you are hard pressed for memory in a program and are using no string variables, you can free 50 additional bytes of memory by executing a CLEAR 0 at the beginning of your program.

There are four ways to use clear. The CLS (Clear Screen) command in a program and the clear key on your keyboard wipe the monitor screen of all content. Neither affect variables in storage, but both terminate the doublewidth print mode initiated by CHR\$(23). The clear command used in a program by itself, with no number following, wipes out the content of all variables returning them to zero for numeric variables and to null (" ") for all string variables. Clear followed by a number reserves that number of bytes of string space for your program and zeros all variables. If you are using many strings, you should CLEAR n bytes early in a program, before any variables are introduced. Unless you do so, you will face the OS (Out of String Space) error message.

Clearing 10000 bytes will accommodate nearly 250 each of nouns, verbs, and adjectives. Since the program itself occupies little space, you need not be

The Key Box Cassette Basic Model I or III 16K RAM overly concerned about reserving a large amount of string space in this program.

Lines 100-150 count the words in each data category, first nouns, then verbs, and then adjectives. Nouns are stored in data lines 2000-2998, verbs in lines 3000-3998, and adjectives in lines 4000-4998. The data entries of End at lines 2999, 3999, and 4999 halt the counting of nouns and switch to the counting of verbs and then to the counting of adjectives. Line 160, by subtracting the Ends from each count of words, places the actual number entered by the user in the variables N, V, and A. Line 170 sets the string variables N\$, V\$, and A\$ to null, or blank. This is good programming practice unless you are hard pressed for memory space.

Line 180 dimensions the arrays we are about to create. The Basic operator is DIM. TRS-80 Level II Basic's default value for any array is 11 (0-10), so the dimension command must be used only if and when, as in this case, a larger number of elements are to be antici-

pated. How many of each? Line 160 has given us that count. We dimension N\$ to N, V\$ to V, and A\$ to A.

Line 190 restores the data stack for reading again. The first time we went through it, in lines 100–150, we were merely counting the words. Now we must restore the stack so we can actually read it, word by word, into usable memory. Line 210 presents screen material to entertain the user while the data is being read into arrays N\$(x), V\$(x), and A\$(x) by the read function.

Lines 240-280 are the heart of this program. A\$ was one word (or sequence of words) when we were counting and replacing previous content with new content at each count, but not now! This is where we spin data into one-dimensional arrays. N\$ is as many different words as you have dimensioned for and have in data to put into the prepared slots. N\$(1) will be the first noun in your data, N\$(2) the second, and so on up to N\$(150) or N\$(306) or whatever.

You could read these nouns into

memory by programming something like READ N\$(1): READ N\$(2): READ N\$(3) and so on. This takes lots of typing and lots of memory space. Lines 240, 260, and 280 spin those same words into memory, using For...Next loops, in a few seconds. At each pass through the For...Next loop they are incremented by one, going up from one to whatever total value N and V and A hold. Each pass through the loop, therefore, produces a different subscripted variable—N\$(1), N\$(2), and so on.

Lines 250 and 270 read and eliminate the End entries that separate nouns, verbs and adjectives. Now we have all the data in usable memory. You can check this by inserting a line:

```
285 FOR Q = 1 TO N: PRINT N$(Q): NEXT
: FOR Q = 1 TO V: PRINT V$(Q): NEXT
: FOR Q = 1 TO A: PRINT A$(Q): NEXT
```

Your nouns, then your verbs, and then your adjectives will cascade down the monitor screen, and then stream up as the bottom line fills and bumps them upward. Remember to cancel line 285 by typing in 285 and hitting enter before you run the program.

Line 500 first sends us to the random number generator planted at line 5000, and then to a poem format (there are more than a dozen in the actual program) to create a poem. The random number generator makes it likely that each poem will be different. The more words in data storage, the more likely it is that each poem will be different. Line 1999 provides an easy way to punch up another poem; you simply hit enter.

To use this program, enter as many words as you wish beginning on line 2000 for nouns, line 3000 for verbs, and line 4000 for adjectives. Each new line must begin with data and each word must be separated by a comma from the next. If you wish, write your own additional poem formats, using the listing's format in lines 500 and 510 as an example. If you do this, change the GOTO in line 1999 to GOTO 490 and add:

490 F = RND(6): ON F GOTO 500, 550, 600, 650 700, 750

For eight formats you would substitute RND(8) and add 800, 850 to line 490. Place a GOTO 1999 at the end of each format.

Writer and businessman Chidsey uses his Model III in both activities. He can be reached at 205 E. Adams St., Green Springs, OH 44836.

```
10 CLS: PRINT 0276, "POETRY GENERATING PROGRAM"
20 PRINT 0344, "(MINIMUM VERSION)"
30 PRINT 0601, "BY JAY CHIDSEY"
40 PRINT 0725, "GREEN SPRINGS OH 44836"
50 PRINT 0980, "";: INPUT "PRESS ENTER TO CONTINUE"; YY
90 CLS: CLEAR 10000
100 READ NS: N=N+1
 110 IF N$="END" THEN 120 ELSE 100
 120 READ V$: V=V+1
 130 IF V$="END" THEN 140 ELSE 120
 140 READ A$: A=A+1
 150 IF A$="END" THEN 160 ELSE 140
160 N=N-1: V=V-1: A=A-1: REM
170 N$="": V$="": A$="": REM
                                           SETS N, V, A TO ACTUAL COUNT
                                            SETS STRINGS TO BLANK
180 DIM NS(N), VS(V), AS(A)
190 RESTORE: REM DATA NOW READY TO BE REREAD FOR CONTENT 200: PRINT: PRINT TAB(18) "POETRY GENERATING PROGRAM"
210 PRINT:PRINT:PRINT
: PRINT"WORDS IN STORAGE:": PRINT: PRINT
         PRINT"NOUNS....."N
       : PRINT"VERBS.....
       : PRINT"ADJECTIVES....."A
240 FOR X=1 TO N: READ N$(X): NEXT
250 READ EN$:
                           REM PEELS OFF 'END'
260 FOR Y=1 TO V: READ V$(Y): NEXT
270 READ ENS
280 FOR Z=1 TO A: READ A$(Z): NEXT
290 PRINT: PRINT: INPUT "PRESS >ENTER< TO CONTINUE"; YY
500 CLS: GOSUB 5000: PRINT: PRINT
      : PRINT TAB(25) "THE " N$(X): PRINT: PRINT: PRINT: PRINT: PRINT, "HOW " A$(Z) "LY " V$(Y) "S THE " PRINT, "" N$(X) "S SELDOM " V$(Y) "."
                                                                  " N$(X) "!"
PRINT, "NS(A) SELDOM VS(I)

510 GOSUB 5000: PRINT
: PRINT, "MORE "A$(Z) " ARE THE " N$(X) "S,"
: PRINT, "AS THEY " V$(Y) "."

1999 PRINT: PRINT: PRINT
: PRINT "PRESS ENTER FOR ANOTHER POEM"
: INPUT "PRESS BREAK KEY TO EXIT PROGRAM"; YY
       : GOTO 500
2000 DATA STONE, RING, CLOUD, BARN, DOG, CAT, MOUNTAIN, RIVER
2999 DATA END
3000 DATA RUN, JUMP, FLY, SEE, PLAY, THROW, SING, SHOUT, CLIMB
3999 DATA END
4000 DATA BEAUTIFUL, SORROWFUL, GOOD, SCENIC, PURPLE, SWEET
4999 DATA END
5000 RANDOM: X = RND(N): Y = RND(V): Z = RND(A): RETURN
                                     Program Listing
```

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Double density disk storage—a close look at all you will ever need to upgrade your Model I.

Model I users have always been plagued by a problem called data separation, when the disk controller has trouble separating data from other bit streams of information, such as the clock cycle. This problem can become severe particularly when you are formatting or writing to the innermost tracks of a disk. With double density (since the current double-density disk controllers all use a built-in data separator), disk I/O is actually more reliable than single density. My old drives reported fewer disk read/write errors from single-density I/O with the Radio Shack disk controller when I moved up to double density. You can store more information on a double-density disk as well-184,000 bytes on a formatted disk. With a four-drive system, singledensity users are limited to a meager 332,000 bytes of on-line storage, whereas double-density users can have up to 700,000 bytes on-line.

How do you get double density? Which disk controller and DOS should you choose? There are a wide variety. I contacted many manufacturers of double-density products, and those that responded are represented here.

Two double-density disk controllers, five DOSes, and four disk drives are re-

viewed. Although most of this information is applicable to Model I users only, four of the DOSes have Model III versions.

Indispensable in my testing of the disk drives and disk controllers was the Floppy Doctor, a product of the Micro Clinic in Fountain Valley, CA. The utility comes on a self-booting disk and has a memory test and nine disk-drive tests.

#### The Disk Controller

The disk controller is the circuit in the expansion interface that lets the computer talk to the disk drive. The Western Digital disk controller that accompanies the Radio Shack Expansion Interface is a single-density disk controller, but it can write several kinds of DAMs (data address marks). To allow compatibility, both the Percom and LNW disk controllers allow your computer to use the original disk controller as well as the double-density disk controller

You install both in the same manner. First, dismantle the Expansion Interface and remove the disk-controller chip from its socket. Next, plug the old disk controller onto your new disk-controller circuit board (which houses an additional, double-density disk controller) and plug the new circuit board into the disk-controller slot. It will take about 5–15 minutes to install, depending on your familiarity with the parts involved. It requires no soldering, trace cutting, or any modification to existing circuits.

I reviewed the Percom Doubler II and the LN Doubler 5/8. The Percom Doubler comes with easy-to-follow in-

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structions and Percom's own DBLDOS; essentially a TRSDOS patched to run double density with a few corrected flaws. It sells for \$169.

The LN Doubler 5/8 comes with better instructions and an even easier installation manual. The manual includes the Western Digital technical manual for their disk controllers. The LN Doubler 5/8 also supports eightinch floppy drives (if you have the necessary speedup enhancement to your Model I), and comes with DOSPLUS, a much better disk operating system. The LN Doubler 5/8 sells for \$220.

Are they different in performance? No. I was unable to demonstrate a significant difference in any disk-controller functions between the Percom Doubler II and the LN Doubler 5/8. Reliability testing showed no significant differences in granules locked out or in read/write errors. This was using the brand new drives I received for this review and older Pertec drives. New Maxell disks were used and were formatted to 40 tracks using double density.

#### The DOSes

A disk operating system is a program that controls computer operation in a disk-based computer system. The aspects of a DOS that I consider important are: ease of use; speed of operation; accompanying utilities, such as editor/assemblers, file utilities, debuggers, monitors, and languages; readability and completeness of documentation; compatibility with other disk formats; and cost.

The DOSes reviewed here all support double density and are available for the Model III. They are MULTIDOS, NEWDOS80 2.0, DOSPLUS, and LDOS.

#### **MULTIDOS**

MULTIDOS, written by Vernon Hester, is the most inexpensive of these DOSes and has many features its more expensive competitors don't have. It is the only totally compatible DOS around. It will read any of the other disk formats, including DBLDOS (none of the others will). It is also a "no-hang" DOS, meaning that even if you remove the operating system from drive 0 and the DOS tries to access the system utilities on the DOS disk, it won't up and quit, as will the other DOSes. It won't do what you wanted, but it will remain in control of your computer. One useful, although perhaps minor, convenience is that pressing the enter key without input will reexecute the last DOS command. MULTIDOS is a fast DOS as well.

The only major problem with MULTIDOS is that it only checks four times on a read/write. My old Pertecs show many more "Data Record Not Found" errors with MULTIDOS than the other DOSes, which check 10 times before returning an error.

The manual is a terse 66 pages (not including a few pages of errata and additional information). It lacks an index, but covers the features of MULTIDOS adequately, provided that you already have the TRSDOS manual. This complaint is true of NEWDOS80 as well. DOSPLUS and LDOS have manuals that don't require that you have read the TRSDOS manual to understand them.

MULTIDOS has many useful library commands besides those provided in TRSDOS. You can disable the break key from DOS, and build and execute DO files (although you cannot run a Basic program and pass input to the Basic program from the DO file). Some of MULTIDOS's commands include: Forms, which lets you specify lines per page and line length for printed output; Hash, which returns the hash code of a file ID; and KEYBRD, which sets the keyboard parameters. MULTIDOS has a default keyboard driver that provides a repeating, flashing block cursor, but this can be changed with the KEYBRD command. Link and Route control the I/O of data to the video and printer. You can send everything that goes to the printer to the video too (or instead) and vice versa. Topmem allows you to set the topof-memory pointer from DOS.

MULTIDOS has a number of useful system utilities. Backup lets you make speedy backups on a single drive and alter the number of tracks on it at the same time. Copy allows single-drive copying of single files, including to and from non-MULTIDOS disk formats. Format formats disks in single, double, or P (DBLDOS) density formats.

Other utilities include a disk-based version of Radio Shack's Editor/Assembler, a RAM Scanner to locate a one or two-byte word in memory, a graphics utility to allow direct keyboard entry of graphics characters, a printer spooler, and best of all, MULTIDOS's Versatile File Utility (VFU).

VFU is a utility for frequently needed disk operations, including purging files, printing a disk directory, multiplying file copies, and executing menubased programs. The Purge option gives a screen of the available files, as do the Copy and Execute commands.

MULTIDOS has the best Basic around, SuperBasic. It also has a programming and debugging Basic called BBasic with Boss built into it. Super-Basic is the smallest Basic available since it uses extensive overlays for various operations—SuperBasic leaves 40,000 bytes free after loading. Basic can be loaded directly, recovered (with BASIC\*), and it provides two more options: BASIC! loads Basic and recovers a program left there by a non-MULTIDOS Basic. This means you can recover a Basic program left from running DOSPLUS or NEWDOS80 and recover it by inserting a MULTI-DOS disk in drive 0, pressing the reset key, and typing BASIC!. BASIC# recovers a Level II program in memory. The recover utilities allow direct continuation of a program. SuperBasic provides a special form of Level II to provide even more memory when needed.

BBasic incorporates Boss into Basic, and allows single stepping of Basic programs, reviewing the current values of any set of variables at any time, breakpoints, and an improved trace function. Other than this, BBasic is just like SuperBasic, except it takes up more room.

SuperBasic allows you to use singlekey abbreviations for some commands. It also has a Pn command to display a requested page of a program. Several additions to Basic are provided with CMD"xxx" commands. CMD "C" compresses your program without eliminating remark statements. CMD"E" displays an error message associated with the last disk error. CMD"K" zeros all elements of an array. CMD"L" deletes an array. CMD"M" moves a program line. CMD"N" duplicates a program line. CMD"O" opens an additional file buffer. CMD"Q" performs a string sort of a single or double-dimension string array, and CMD"V" displays all current scalar variables and their

SuperBasic has overlay utilities to renumber parts of your Basic program, search for ASCII strings within program text, change all or part of variable names, change graphics codes (CHR\$(X)") into packed strings and it provides a cross-reference utility that shows all line numbers that contain specified variables. SuperBasic uses Name to chain programs without losing variables. I think SuperBasic is the

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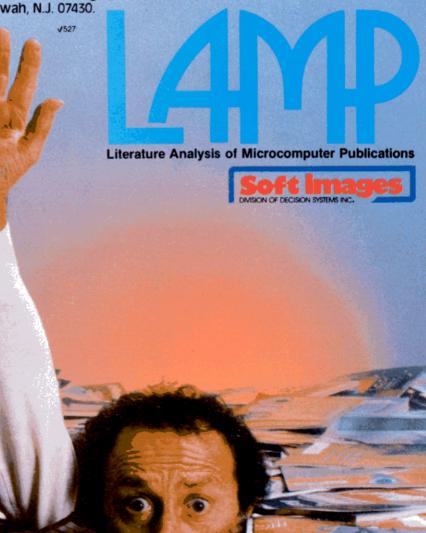
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#### **NEWDOS80 2.0**

NEWDOS80 2.0 is a double-density DOS that writes and reads a specific disk format differently from the other DOSes. The familiar gran for granule has been replaced by lumps. What's a lump? NEWDOS80's documentation doesn't go out of its way to tell you. It is definable with the PDRIVE GPL parameter, so that there are between two and eight granules per lump. You can define the granules-per-lump (GPL) parameter as eight. Once you do so, the DOS's features are about the same as in the others.

NEWDOS80 2.0 will read other formats, but they must be configured with the PDRIVE (similar to MULTIDOS's CONFIG) each time a different disk is used, particularly if the disks are in different densities. To get around this problem, The Alternate Source sells a program that gives NEWDOS80 2.0 automatic density recognition. This program is called DDSD and costs \$19.95.

One of the examples in the PDRIVE section implied that I could read the directory of a Model III disk. I was unable to read the Model III disk's directory with NEWDOS80 2.0. You can, however, copy from a Model III TRSDOS disk on a Model I with this DOS.

It will take you longer to get started with NEWDOS80 than with the other operating systems presented here. This is partially due to the manual's technical approach, and partially to the approach taken by the DOS in its performance of the various functions. All the other DOSes allow you to back up a disk with the familiar Backup command, but NEWDOS80 requires using the Copy format. Once learned, NEWDOS80's approach is quite useable and powerful.

NEWDOS80 has a large number of library commands. The most notable are:

- Break—enables and disables the break key:
- Chain and DO—shifts to the disk file for command input:
- JKL—sends the current screen contents to the printer;
- HIMEM—sets the top of memory from DOS;
- ◆ LC and LCDR—toggles the lowercase driver (Model I only);
- Pause—displays the message and pause until enter (for use in DO files);
- PDRIVE—assigns the default attri-

butes to a physical disk drive;

- Print—outputs a text file to the printer;
- R—repeats the last DOS command; and
- Route—routes one device to

NEWDOS80 also sports a miniDOS not found in the other DOSes. The miniDOS allows the execution of DOS library commands except Append, Chain, Copy, or Format. Since it is interrupt driven, it can be used from almost any program that keeps interrupts active and uses the NEWDOS80 keyboard driver.

The utilities provided by NEW-DOS80 include the ever-popular Superzap. It also supplies a patched version of Radio Shack's Editor/Assembler and a disassembler. The disassembler writes disassembled code to disk from where it is loaded by the patched assembler. It will also send the disassembly to the printer or screen and display a cross-reference table.

LMOffset is a program used primarily for loading system tapes that overlay the DOS and store them on disk. Chainbld is used for the creation and editing of Chain or DO files. ASpool is a printer spooler.

NEWDOS80 also sports an enhanced Basic. Enhancements include toggling the break key, abbreviated line listing and editing commands similar to MULTIDOS's SuperBasic. Chaining is allowed and the Merge command merges non-ASCII files. REF displays a reference list of variables and line numbers, and can specify different outputs in a number of ways.

CMD"F = ERASE" and CMD"F = KEEP" allow selective clearing of Basic variables, like the MULTIDOS SuperBasic CMD"L", only more powerful. The first format selectively clears a number of variables in a single statement, while the second format clears all except the declared variables. Some other CMD enhancements include clearing all Returns and For...Next loops from the stack, dynamic deletion of text lines, swapping of variable contents, singlestepping Basic, recovering a deleted program (providing it hasn't been overwritten in memory), and sorting arrays. CMD"O" sorts a multidimensioned array.

NEWDOS80 has some extensive disk I/O enhancements to Basic as well. The manual spends 20 pages discussing these disk I/O enhancements in chapter 8 alone; appendices A and B

feature 65 more pages on the topic.

NEWDOS80 handles the standard sequential (which they call print/input) and random (which they call field item). It also handles marked item (which has three subtypes) and fixed item (which has two subtypes). Random-access files can be of 1-256 bytes in fixed length. The fixed time and marked item files have a maximum record length of 4,095 bytes.

Sequential files can only be accessed sequentially. That is, if you want to read item number 200, you must wade through the first 199 items. Random-access files can access record number 200 directly and are more useful and powerful.

In fixed and marked item files, Get and Put are used to access data in the I/O buffers. The type and length of each item is determined by the IGEL (item group expression list) of the Get and Put for fixed-item files, but in marked-item files, the item always begins with marker bytes, specifying the format of the item. Although they are initially hard to understand, these new file types are quite useful.

NEWDOS80 is a good DOS. The Basic is not as good as MULTIDOS's, but it operates well. It has a disassembler, Superzap, and other powerful utilities. Apparat supplies zaps free to registered owners and has provided good customer support in the past. Unfortunately, it does not have automatic density recognition.

#### **DOSPLUS 3.4**

DOSPLUS comes with the LN Doubler 5/8. It has automatic density recognition, although it cannot read DBLDOS format.

The approach to operating system functions took a departure from TRSDOS with DOSPLUS. The DIR command automatically displays the information normally supplied with DIR (A) in TRSDOS, and a new command, CAT, displays the abbreviated directory normally retrieved with DIR in TRSDOS. It would be nice if the DIR command displayed the number of granules left.

DOSPLUS has an automatic repeating, lowercase keyboard driver and DO-file capability. The Format command works quickly and verifies the tracks backwards rather than forwards to save time (since the drive head is already at the highest track, it needn't move back to track 0). DOSPLUS Model I and III double-density versions are directly compatible, meaning that a Model I DOSPLUS disk can be

read by a Model III DOSPLUS. This does not mean that a Model I DOSPLUS can read a Model III TRSDOS disk. DOSPLUS does come with a Convert command to transfer files from a Model III disk to a DOSPLUS disk, somewhat like NEWDOS80.

Although DOSPLUS does not have a VFU command similar to MULTIDOS, Picotrin Technology of Lantana, FL markets a DOSPLUScompatible program that provides cursor-oriented functions.

The DOSPLUS manual is reasonably well done except for the omission of an index. The technical section is particularly good in how it describes the entry and exit points for the various DOS routines and DCB (device control blocks).

The library functions are similar to the DOSes previously described. The DO construct works well and lets you specify in the command the reserved high memory for the DO file.

The DOSPLUS utilities include a printer spooler, single-drive copy, Crunch (a program that compresses Basic programs saved on disk), Diskdump and Diskzap (floppy-disk editors similar to Superzap), Map (shows file locations on a disk), Restore (recovers killed files), Sysgen (creates nonstandard system disks), Tape (similar to NEWDOS80's LMOffset), and Transfer (for multiple file copies from one disk to another).

DOSPLUS enters Basic differently than MULTIDOS or NEWDOS80. The Basic is enhanced as well. TRON allows you to single-step Basic, and Tab tabs on a line printer beyond 64 columns. You can move and copy Basic program lines, and DOSPLUS Basic has a large number of abbreviates.

DOSPLUS also comes with a tiny Basic called TBasic. TBasic occupies slightly more space than MULTIDOS's SuperBasic, but has no file space allocated. TBasic lacks many of the enhancements found in regular DOSPLUS Basic, but is useful because it will still run the full set of Basic commands. TBasic displays abbreviated error messages in a further attempt to free up memory.

#### **LDOS 5.1**

LDOS recently reduced its price from \$169 to \$129, due to the large volume of sales. Registered LDOS users receive a quarterly magazine called, appropriately enough, *The LDOS Quarterly*, support hard to match.

LDOS comes with a rather imposing

300-plus-page, well-written manual. The LDOS manual is the best of the DOSes reviewed here.

In order to make LDOS run with double density, you must use the PDUBL disk-driver program, which sits at the top of memory. This creates some real hassles with programs in high memory at times. You can use the Sysgen command to save the driver configuration so it automatically loads on boot. Model I users cannot boot up on a double-density LDOS disk—it must be single density, although you may change it to double density after the boot, a minor inconvenience.

LDOS on the Model I will not read a Model III TRSDOS disk, although the library command CONV can be used to transfer files from a Model III TRSDOS disk.

The library commands in LDOS are similar to those available in the other DOSes. Trace supports and displays the PC register in the upper right corner of the display, and Filter is similar to the Route command on other DOSes but better. It establishes a program to filter the I/O path of some device. Several filter programs are supplied with the LDOS disk.

MINIDOS/FLT is a filter similar to NEWDOS80's miniDOS. In it, you can toggle the clock on and off, enter Debug, display free space, kill files, and so on. A filter for the line printer is also provided.

One of the most powerful features of the LDOS operating system is its job control language (JCL). A DO or Chain option is available for all the other DOSes, but a true JCL is lacking. The LDOS JCL is actually a compiled language. It can handle conditional statements and support variables. LDOS allows concatenation of variables (which they refer to as tokens) and logic expressions using NOT, AND, and OR. LDOS JCL allows macros in its programs. This means that you can specify a macro name and some complex function will be performed.

The JCL feature is a powerful one, although it could be made more powerful by adding the ability to direct execution of the JCL program on the basis of the results of some program. An interactive control language (ICL) is available for NEWDOS80 version I and it allows this flexibility.

One of the utilities includes CMDFILE. Similar to NEWDOS80's LMOffset but more powerful, this program allows appending patches to machine code, appending machinecode programs together, saving them to disk or tape, moving them around in memory, and so on. CONV moves files from a Model III TRSDOS disk to an LDOS disk. Since this program can be used by a Model I running double density, this provides the only utility to move programs from a Model III disk to a Model I disk. LCOMM is a communications program that allows your TRS-80 to talk to other TRS-80 computers or to bulletin board systems, such as Forum 80. Repair updates and corrects information on certain types of disks to make them useable to LDOS. This utility is more useful for Model III users than for Model I folks.

LDOS's enhanced Basic, LBasic, has some abbreviations and allows single-stepping of Basic programs. Restore has been updated to allow you to specify a line number to start the Restore at. LBasic allows chaining of Basic programs without loss of variables. LBasic can also sort arrays and provide reference information on Basic programs. LBasic is good, but in my opinion, not as good as the Basics in the other operating systems.

LDOS is a good DOS, but there are a few minor inconveniences. The Basic could be more powerful, and it would be helpful if the top of memory was free. (PDUBL sits at the top of memory if you're using double density.) The manual is quite good, and the Filter and JCL features make this the most powerful microcomputer DOS around. Finally, the LDOS support is unprecedented in quality and ease for the registered user.

#### In Summary

As you can see, all these DOSes have their good points. MULTIDOS has its low price tag, versatile file utility, nohang ability, virtually total compatibility, and the excellent SuperBasic. The manual is a bit terse and MULTIDOS only checks a read/write four times.

NEWDOS80 has good utility programs like LMOffset, a disassembler, and Superzap. The manual, however, is lacking a tutorial and NEWDOS80 needs automatic density recognition. DOSPLUS has Diskdump, Diskzap and automatic density recognition. LDOS has its excellent manual, great customer support, very flexible filtering of I/O, and a powerful JCL. Which you choose depends very much on your applications.

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location and rotate the disk within precise limits so that address marks and data can be accurately located. The drive speed is supposed to be 300 rpm. Most drive manufacturers say that a one-percent variation in drive speed is tolerable, and often a precisely adjusted drive will still vary within  $\pm$  one percent of 300 rpm.

Older minifloppy disk drives had 35 tracks and wrote only in single density. Technology has improved, and now 80 and even 96-track minifloppy drives are available in single or in double density.

I was hoping to find differences in reliability of the brand new drives under severe stress-testing conditions. As long as I kept below the upper limit of the speed of the stepping motor of the drive, I was unable, generally, to get any errors in these drives. I could find no clear-cut reliability differences among the various drives, so it was impossible to statistically investigate the presence or absence of an interaction of effects due to the disk controller used. I did, however, discover differences in their operation. The drives I reviewed are: Percom model TFD 100-1, PMC model SFD-51-A. Teac, and Trak model 5410-121.

The Percom is the only one of these drives that is flippy, meaning that you can remove the disk from the drive. flip it over, and reinsert it into the drive and write to the other side of the disk. This effectively doubles the amount of storage you have in your disk library. The Percom drive also has the drivecable card extending out from the rear of the machine, so it is easily accessible without removing the case, a nice feature. It has a stepping-motor speed that allows you to seek tracks at 12 milliseconds. This is faster than the Teac (at 30 ms) and my Pertecs (at 20 ms), but slower than the PMC and the Trak (both at 5 ms). The list price of the Percom drive is \$305.

The PMC drive also has the drivecable card extending out the rear of the drive. It has a fast-stepping motor with 5-ms track seeking. It allows writing only to one side of the disk.

The Teac drive was the slowest of the bunch, requiring a minimum of 30 ms to seek a track. In order to change the drive cable, you must remove the cover. The card for the drive is inconveniently spaced, meaning the drives must be slightly closer than recommended by Radio Shack when using their four-drive cable. The Teac drive I

used was loaned to me by American Business Computers. They give their Teac drives a one-year warranty. All the other disk drives were loaned by the manufacturer.

The Trak drive was another fast drive, requiring only 5 ms to seek a track. The card for the drive cable was even more inaccessible than the Teac drive, and to use it with the four-drive cable, it requires you to run the drive with the cover removed, use the last connector on the cable, or use a diskdrive extender cable, which costs about \$10. It came with a single-drive cable already connected to it, so single-drive users won't need to get a cable when purchasing this drive. A nice feature of this drive is the disks are spring loaded. When you wish to remove a disk, you open the drive door and the disk springs out a half inch or so for easy removal. This is also the only drive with a power-on light as well as a drivebusy light.

The disk drives all worked reliably. I prefer the Percom drives because of the easy cable hook-up and relatively fast operation, but primarily because it was flippy. Nonetheless, all the drives worked well and deserve a recommendation.



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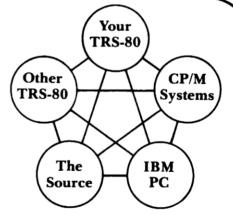
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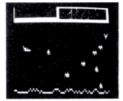
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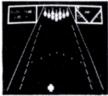
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By Westmoreland & Gilman from Adventure

Underwater adventure is yours as you command a nuclear sub armed with deadly missiles and torpedoes. Guide it carefully through sea mines and underwater mountains; watch out for depth charges being fired by overhead ships...and don't run out of air! Scrolling sea bottom for added excitement Joystick compatible

16K Tape, \$19.95 32K Disk, \$24.95



### ELIMINATOR

oreland & Gilman from A.I.

You'll need all your keyboard manipulative skills to keep up with the action in this arcade game. You travel across the planet's low-altitude airspace in an effort to prevent the marauding enemy from capturing your energizer cells. All manner of alien craft await your arrival with destructive forces. For 1 or 2 players, with sound.

16K Tape, \$19.95

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## FORCE

From Melbourne House

You are the warrior-savior of cities under relentless alien attack. You're armed with rapid-fire missiles, radar and incendiary star-shells; but you'll need your fastest thinking and instantaneous response to protect yourself and your people. Great real-time

16K Tape, \$15.95

32K Disk, \$19.95

### PENETRATOR

From Melbourne House

Armed with missiles and bombs, you must fly your fighter to the enemy's cache of neutron bombs and destroy them. Your mission is in four stages, involving rugged terrain, caverns and manmade obstacles-not to mention enemy radar, missiles and paratroopers. This new departure in arcade gaming allows you to set up your own terrain and enemy emplacements, then save them for future use. Make your mission as hard or easy as you like. Joystick compatible.

16K Tape or 32K Disk, \$24.95



By Demas from Fantastic

An arcade style game of a fascinating future world with high-res graphics and voice. Filled with action and excitement; in machine language

16K Tape, \$19.95



#### VENTURE

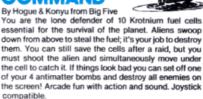
By Phillip Case from Horizons

Set off on a journey into the stronghold of an ancient wizard. Danger is everywhere, and the penalty for a mistake may be complete destruction! The ultimate challenge lies in the forbidden Riddle Roomready for the VENTURE? With sound effects: joystick compatible.

16K Tape, \$14.95

16K Disk, \$19.95

## DEFENSE COMMAND



16K Tape, \$15.95 32K Disk, \$19:95 Now Thru Dec. 10: Tape \$14.36; Disk \$17.96



## ESCORT

By Jeff Zinn from Big Five

This new arcade game from Big Five continues their tradition of bringing you the most exciting action in innovative space games. Your fighting spacecraft must run the gauntlet of the attacking alien's weaponry in order to accomplish your defense mission. You'll use all your skill and dexterity just to survive! Joystick compatible.

16K Tape, \$15.95 32K Disk, \$19.95 Now Thru Dec. 10: Tape \$14.36; Disk \$17.96

## ROBOT ATTACK

By Hogue & Konyu from Big-Five

One of the top names in TRS-80 arcade games adds a new dimension: voice sound effects! It's you against the robots in this fast-moving shoot-em-up. Electrified Mazes and the "Flagship" complicate things as you stalk the evil androids

The innovations built into ROBOT ATTACK take your TRS-80 near the limits of its capabilities. You MUST see and hear it! Joystick compatible.

32K Disk, \$10:95 16K Tape, \$15.95 Now Thru Dec. 10: Tape \$14.36; Disk \$17.96

## Four From Bia-Five

By Hogue & Konyu

COSMIC FIGHTER **GALAXY INVASION METEOR MISSION 2** ATTACK FORCE!



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## Adventures in Learning,

## LANGUAGE **TEACHER**

By Cindy and Andrew Bartorillo from Acorn Learn the basics of a foreign language. LANGUAGE TEACHER offers hundreds of word combinations, verb conjugations and phrases. There is an option for having multiple-choice answers and for being retested on missed items. Full printer capability and a great deal of "human engineering" further enhance the programs. Teachers will appreciate the ample documentation and the ability to get printouts of guizzes. Currently available languages are: French, Spanish, Italian and

32K Disk, \$29.95 for each program.



By Chuck Acree from Acorn

YOUR

This comprehensive genealogical program sets up a database to display/print a complete "pedigree" for any family member or 3-generation chart, includes name, date and place of birth, marriage and death information, and comment line for each. Also displays a US outline map showing migration across the

16K Tape or Disk, \$29,95

### MONEY MANAGER By Andrew P. Bartorillo from Acorn



A complete management tool for the home budget, it keeps track of your checkbook and provides for easy budget allocation. You can store information on up to 100 checkbook entries per month (250 with 48K), specify automatic withdrawals, keep records of tax deductibles, record expenses by category, even break up charge account payments into the proper

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## VISICALC HOME AND OFFICE COMPANION

By Castlewitz and Chisausky from Osborne/McGraw-Hill

Fifty VisiCalc models for home and office, including investments, inventory, sales forecasts, payroll, per-sonal net worth, home budget planning, family insurance needs. Each comes with model listings, sample printed reports and narrative

A must for every VisiCalc owner! Softcover, \$15.99

## **TYPING** TUTOR



By Ainsworth & Baker from Microsoft Speed up your programming and word processing with this excellent touch-typing instructional program. Divided into two sections, the program first teaches proper finger positioning. You practice keying various characters, the program adding new ones as you progress. In the practice paragraph section, you are evaluated for accuracy and rated in words per minute. The program continuously adjusts to your increasing skill, telling you which characters you miss and where you are slow. One of the most practical programs we know of for TRS-80

16K Tape, \$19.95 (Model I only)

**POWER** DRAW

By Kim Watt from Powersoft

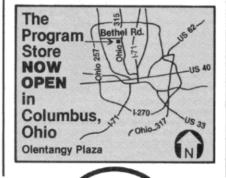


### INSTANT SORT/SEARCH DATABASE

By G. Hatton From Acorn

A database program that allows the user to store a large number of files in the form of lists, and provides the user a means to retrieve specific items of information from the file. Written in machine language, ISS can provide a multitude of sorts, subsorts, searches and categorizations in seconds. Because the processing is done in memory, it is extremely fast, and you can manipulate the data at will without risk to your database on tape or disk. (If further information is required, please call or write.)

16K Tape or 32 K Disk, \$49.95



## Programmers' Corner

### LDOS

From Lobo

An advanced operating system that offers benefits to everyone from novice to advanced system programmers. LDOS comes with one of the most complete and well written documentation books ever, with easy-tofollow instructions to get started plus a wealth of advanced information for when you need it. Completely device independent, LDOS provides for routing, linking, setting, and filtering of the input/output of a number of peripherals. Up to eight disk drives are supported in almost any mixture: 5", 8", single/double density, up to 80 tracks, even hard disks.

Endorsed by Radio Shack. Disk with Manual, \$129.00 Please specify Model I or III.

FREE: Box of 10 Diskettes with each LDOS order!

Please state choice of:

Memorex, BASF, Nashua, Leading Edge, Athena, 3M. Offer ends Dec. 25, 1982.

#### FINEFONT

By Vincent Bly from Acorn

Now Epson owners can have true letter-quality printing with FINEFONT at 10, 11, or 12 characters per

Finefont and Epson

With boldface, underlining and incremental spacing (for proportional right justification). 32 special characters including those needed for mathematics, plus a graphic editor to create or edit character sets. It supports all Epson print modes, and is compatible with word processors including Model I SCRIPSIT with SUPERSCRIPT, Model III SCRIPSIT, and Lazy Writer (Model I, III). Print speed is approx. 20 CPS, unidirectionally. It's compatible with most DOS's including LDOS 5.1, TRSDOS, NEWDOS/80 Ver 2.0. Requires following Epson printers: MX-80; MX-80 F/T with Graftrax-80 or Graftrax-plus; MX-100 with Graftrax-plus only.

Requires 48K Disk, \$49.95



By Richard Wilkes from Acorn

Using your SuperScript modified Scripsit Word Processor and a compatible printer, you can now underline, boldface, insert text during printout, slash zeros, set type pitch, subscript and, of course, superscript! You can even read your directory and kill files without ever leaving Scripsit.

SuperScript comes with drivers for popular serial and parallel printers (now including Centronics 737 and RS Daisy II), and easy instructions for patching to your Scripsit program (does not include Scripsit).

32K Disk, \$49.95 Use Model | Scripsit

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### HELLFIRE WARRIOR



From Epyx

This sequel to TEMPLE OF APSHAI gives you 4 new levels of dunjons with 60 rooms each! You'll find giant insects, skeletons, ghouls, mummies, dragons and bottomless pits. Can you conquer them and rescue the Warrior Maid Brunhild to break the spell that

#### 16K Tape or 32K Disk, \$39.95

Expansion Modules for HELLFIRE WARRIOR (You must have HELLFIRE WARRIOR to play):

THE KEYS OF ACHERON: Find the 4 jewels with the help of a friendly unicorn.

DANGER IN DRINDISTI: Defeat the king's enemies in over 100 caverns and chambers

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### **Warriors** of RAS

By Masteller from Med Systems

In this adventure/role playing series, you create the characters, and can save them for future games, or use them in other volumes of the series.

#### **DUNZHIN, Vol. 1**

You're in a many-level dungeon filled with demons and

#### KAIV, Vol. 2

Can you find the treasure buried deep within the catacombs of the KAIV?

#### THE WYLDE, Vol. 3

The newest in this fascinating series.

**Each Volume:** 

48K Tape or Disk; \$29.95



## **ASYLUM**

From Med Systems \*\*

You are sitting alone at 2 AM. Your eyes are bloodshot as you peer into your computer's screen and cry, "I must be CRAZY!" If this has never happened to you, you've never tried ASYLUM. It's Med Systems most ambitious 3-D graphics adventure yet!

ASYLUM places you on a cot in a small (padded?) room. Periodically the janitor lobs a hand grenade through the window. What you do next could mean escape—or disaster

16K Tape, \$19.95

32K Disk, \$22.95

**ASYLUM II Now Available:** 

16K Tape, \$19.95

32K Disk, \$22.95

Also order **DEATHMAZE 5000**.

Med System's challenging 3-D maze game.

## TANK



Fast-paced 1 or 2 player game with classic arcade action and battlefield strategy. You must predetermine how many hits it will take to wipe out your opponents. and then do it! The battlefield changes randomly after

16K Tape, \$14.95



This exciting new game requires fast arcade response and well-thought-out strategy. Thirty alien warships have entered your Patrol Zone—can you handle your defense? Are your shields up? Have you checked your energy level? Is your azimuth set? OK then

16K Tape, \$19.95



## VOYAGER I

From Avalon Hill You're on board a spaceship infested with killer robots in this graphic science fiction game. You must clear the 4-level 144-location ship of robots and arm it to self-destruct. Can you do it and escape before you, too, are blown up? High-speed graphics are represented in 3-D perspective representing your eye's view; with instant switching to floor plan maps.

16K Tape, \$19.95

## DNIEPER RIVER LINE

From Avalon Hill

It's 1943; you're the German Commander defending the DNEIPER RIVER LINE against the Soviet units, controlled by the computer. Can you hold your position? 4 levels of difficulty; with over 300 illustrated counters and mounted mapboard.

48K Disk, \$29.95

Also available:

TANKTICS: Computer/board game of Germans against Russians in WWII.

16K Tape including wargame board,

### FROGGER



From Cornsoft

One of the most popular arcade games ever available for your home computer! Just as in the arcade game, you must dodge heavy traffic and jump the moving logs in the stream to get home. Fantastic graphics! Requires joystick.

16K Tape or 32K Disk, \$34.95

#### BOUNCEOIDS

We're not sure what they are, but they're huge and dangerous! BOUNCEOIDS bounce off walls, and can kill with one touch. Your mission is to destroy them with your new class 4 annihilator. Then there are the terrible bugs coming out of null space to crunch you to smithereens. You'll need coordination, strategy and courage! Joystick-compatible

16K Tape, \$15.95 16K Disk. \$19.95

# 80

#### SCARFMAN

From Cornsoft

Action-filled arcade game that pits you against the monsters. Race your Scarfman around a maze, gobbling up scoring dots. You are pursued by five monsters: if you eat a "+" they'll lower their eyes and you can eat them, otherwise they'll eat you!

With exciting graphics and sound, SCARFMAN may be played using the keyboard or Joystick. WARNING: MAY BE HABIT-FORMING!

16K Tape, \$15.95 16K Disk, \$19.95 While they last!



## CRAZY PAINTER

Your assignment is to paint the maze, avoiding everyone who tries to stop you. If anyone walks in the paint, it's ruined, and you must go back and repaint it. With sound, great graphics... 'a-maze-ing'

16K Tape, \$15.95 16K Disk, \$19.95

## SPACE CASTLE

From Cornsoft

Ahead of you lies the menacing castle, floating in space amidst its layers of orbiting shields. At intervals, smart mines spin off the shields and head for your ship. Dodging the mines and destroying the shields isn't your only problem, though: once you penetrate the innermost shield, The evil Yugdab will unleash all his fury in an attack! A fast-paced and challenging arcade game, indeed.

THE PR	314.95 32K DISK, 3			9 • 4200 \	— — — — Wisconsin Av	enue, NW • Wash	
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## Make your MX-80 look like a magician.

## **GRAPHTRAX** Tricks

Mark Schneider 3109 Karen Avenue Long Beach, CA 90808

The GRAFTRAX option for my Epson printer has bit-plot graphics; a new italic print font; a backspace feature to help overcome the TRS-80 quirk of including a line feed with every

carriage return; and a TRS-80 mode which accepts graphics in the 128-191 ASCII range of the computer without losing any printer features. These features alone were worth the price, but what kind of characters could I create?

As a math teacher, I used my printer to create worksheets and exams. I had to add many symbols by hand after printing, such as greater than or equal to, less than or equal to, not equal to, square root, divided by, degree, integral, delta and many more. I wanted more than math sym-

bols so I created a whole new alphabet. I designed an alphabet for Hebrew, which does not duplicate any English letters.

#### **Letter Size**

The standard character font on the printer is five across by seven down, with an extra two dots for lowercase descenders. However, the printer plays tricks with some letters, printing between dots. I wanted my letters to be 10 dots wide. GRAFTRAX can print the dots twice as close; my characters print normal width with twice as much detail.

The maximum height allowed is eight, so I used all eight dots: six for normal letters and two for letters with descenders. Each dot is assigned a power of two for a value. The bottom dot is two raised to the zero power, or one. The second is worth two, and so on to the top dot (two to the eighth, or 128). By adding the value of those dots required in each column, you arrive at a number between 0 and 255. LPRINTing that code fires the correct pins and prints the column. The calling sequence LPRINT CHR\$(27)"L"; CHR\$(n1) ; CHR\$(n2) tells the printer that the next n1 + (n2 × 256) characters it receives should be printed as bit image graphics. You may print up to 960 dots on a line.

To print one solid column of dots use LPRINT CHR\$(27)"L"; CHR\$(1); CHR\$(0); CHR\$(255). To underline an entire line (960)

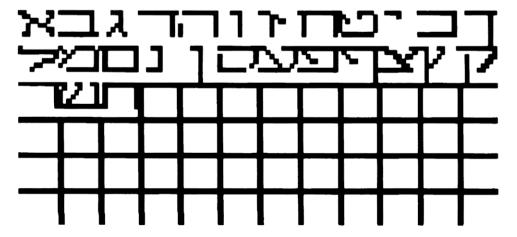


Fig. 1. Screen Display

#### The Key Box

Basic Level II Model I 16K RAM Epson Printer

## THE ULTIMATE IN COLORCOMPUTING

For the TRS-80 Color Computer and TDP System 100 Personal Computer

## Super "Color" Writer II

## The Rolls Royce of Word Processors

The Super "Color" Writer is a FAST, machine code, full featured, character (screen) oriented word processing system for the TRS-80" Color Computer and ANY printer. The video display is styled after a professional phosphor (green characters on black background) display for hours of use without eye fatigue (optional orange on black). The unique print WINDOW frees you from 32, 51 or 64 character lines FOREVER! This window can be moved anywhere in the text file, up, down, left or right to display the text as it will be printed without wasting paper. You can create or edit Super "Color" Terminal files. ASCII files. BASIC programs or Editor/Assembler source listings. It's simple enough for beginners with 4K and . . . for the professional writer with a 32K disk system and a lot to say, there's plenty of room to say it!

COMPARISON CHART	SUPER	COLOR	WRITER	THE	COMPE	<b>TITION</b>
System Size	4K	16K	32K	4K	16K	32K
TAPE: Text space	N/A	7 <b>K</b>	23K	N/A	2K	18K
ROMPAK: Text space	2.5K	16K	31K	N/A	N/A	N/A
DISK: Text space	N/A	5.5K	21.5K	N/A	0.5K	16.5K
Right Justify		YES			NO	
Video Window		YES			NO	
Edit any ASCII File		YES			NO	
Programmable Function		YES			NO	

The figures speak for themselves and with professional features like PROGRAMMABLE function string commands to perform up to 28 commands automatically. PROGRAMMABLE text file chaining, PROGRAMMABLE column insert & delete, and right hand JUSTIFICATION with punctuation precedence, the choice is clear but there's still more! In their September '82 issue, "80 MICRO" says, "The Color Computer has finally come of age. Nothing illustrates that coming of age better than this offering (SUPER "COLOR" WRITER) by Nelson Software". The Super "Color" Writer takes full advantage of the new breed of "smart printers" with Control codes 1-31, 20 Programmable control codes 0-255 for special needs. Works perfectly with all Epson, Radio Shack, Okidata, NEC, IDS, Centronics, Citoh, Smith Corona, Diablo Etc., Matrix, or Letter Quality Printers.

#### **CHECK THESE FEATURES!!**

User friendly • Easy commands • 32K Compatible • Window • Key beep • HELP table ● 128 character ASCII & graphics ● Mem left and Mem used ● Full cursor control • Quick paging • Scrolling • Word wrap around • Tabs Delete character, delete to end of line, line to cursor, line & block • Block move, copy & delete •Global Search, Exchange & Delete • Merge or Append files • Imbed Control Codes in text • Underline • Superscripts • Subscripts . Headers, Footers & 2 Auxiliary footnotes on odd, even or all pages definable position • Flush right • Non-breakable space • 4 centering modes: 5, 8.3, 10 & 16.7 (CPI) • Full page & print formatting in text • Single sheet pause • Set Page length • Line length, Line spacing, Margins, Page numbers • Title pages • Printer baud: 110, 300, 600, 1200, 2400 . Linefeeds after CR . Soft & hard formfeed . Works with 8 bit printer fix • and more!

### Super "Color" Writer II Disk

The Disk version of the Super "Color" Writer works with the TRS-80C Disk System and has all the features listed above plus many more! Use with up to four Disk Drives. Includes an extended HELP table you can access at any time. Call a directory, print FREE space, Kill disk files and SAVE and LOAD text files you've created all from the Super "Color" Writer. Print, merge or append any Super "Color" Terminal file, ASCII file, BASIC program or Editor/Assembler source listing stored on the Disk or tape. The Super "Color" Writer Disk version has additional formatting and print features for more control over your printer and PROGRAMMABLE chaining of disk files for "hands off" operation. Print an entire BOOK without ever touching a thing! Includes comprehensive 90 plus page Tutorial manual.

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## Super "Color" Terminal By Dan Nelson

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**FEATURES** 

10 buffer size settings from 2-30K • Buffer full indicator • Prints buffer contents • Full 128 ASCII keyboard • Compatible with Super "Color" Writer files • UPLOAD & DOWNLOAD ASCII files, Machine Language & Basic programs • Set RS-232 parameters • Duplex: Half/Full • Baud Rate: 110, 300, 600, 1200, 2400, 4800 • Word Lengths 5, 6, 7 or 8 • Parity: Odd, Even or None • Stop Bits: 1-9 • Local linefeeds to screen • Tape save & load for ASCII files, Machine code & Basic programs . Unique clone feature for copying any tape.

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The disk version of the Super "Color" Terminal works with the TRS-80C Disk system and has all the features listed above plus many more! Use with up to four Disk Drives . Call a directory, print FREE space, kill disk files, save and load text files or BASIC programs . Echo ability in full duplex • Lower case masking • 10 Keystroke Multiplier (MACRO) buffers that can be saved on disk to perform repetitive log-on tasks and send short messages (up to 250 characters each) • Programmable prompt or delay for send next line . Selectable character trapping . Set printer Baud rate to 110, 300, 600, 1200, & 2400 • Operators Manual.

**TAPE \$39.95 ROMPAK \$49.95 DISK \$69.95** Operators manual only \$10.00 (Refundable with purchase)

#### Super "Color" Mailer NEW!

Correspondence-Mailmerge

The Super "Color" Maller is a powerful multi-purpose file merging program that uses files created by the Super "Color" Writer II. One of Super "Color" Mailer's most popular uses is producing customized form letters - at a fraction of the time and expense of individually typed letters. With Super "Color" Maller you can combine a Super "Color" Writer II file containg a form letter with a file containing a list of names and addresses. You can even insert special words and phrases - unique to each addressee -- into the body of the letter. Other Super "Color" Maller uses include creating invoices, printing mailing labels, addressing envelopes, and producing "boiler plate" legal documents out of many different paragraphs. Features include: the ability to selectively print mailing lists by any of up to 10 user definable fields • automatically prints current date ◆ address ◆ salutation ◆ closing ◆ P.S. etc. ◆ prints any ASCII file • justification.

**TAPE \$39.95** 

COMING

SOONII

**DISK \$59.95** 

#### Super "Color" Disk-ZAP **NEW!**

The Ultimate in Disk Repair Utilities

A must for ALL Color Computer Disk system owners. A high-speed machine code Disk Utility that can copy sectors and tracks • repair directory tracks and smashed disks, etc. Super "Color" Disk-ZAP has a special screen display that displays sector, track and memory contents in HEXADECIMAL and ASCII at the same time with double cursors that can be moved in any direction. With Super "Color" Disk-ZAP you are able to verify or modify disk sectors at will. You can even type right onto the Disk! You can send sector contents to the printer or any other RS-232 device in either ASCII or HEXADECIMAL listing. Search the entire Diskette for any ASCII or HEXADECIMAL string. Comes complete with comprehensive manual

> **DISK ONLY \$69.95** Super "Color" Calc **Electronic Spread Sheet**

The finest electronic spread sheet and financial modeling program available for the Color Computer - A sophisticated yet easy to use, calculating and planning tool. Project figures into the future to answer the "What if?" questions you face. Create files compatible with the Super "Color" Writer II. Combine spread sheet tables with your documents to create ledgers, projections, statistical & financial reports

AVAILABLE AT DEALERS EVERYWHERE. IF NOT, ASK WHY!!

CHR\$(192); CHR\$(3);: FOR X = values directly to the printer port 1 TO 960: LPRINT CHR\$(1);: (at address 14312), bypassing NEXT X . The Basic interpreter does not correctly LPRINT

dots) use LPRINT CHR\$(27)"L"; ual suggests POKEing these the Basic interpreter. The first example in this paragraph does CHR\$s 0, 10, 11 or 12. The man-not work as written; change it to

```
Program Listing 1. Create File
100 DIML(128):CLS:PRINT"
MX88 Graftrax Worksheet
from DATAWARE by Mark Schneider
This program will aid you in creating bit-graphic characters
for use with an Epson printer equiped with the 'GRAFTRAX'
option."
option.~
118 PRINT:PRINT"Would you like instructions printed out on your
printer?
       one will appear on the screen)!
Y or N ";
128 I$=INKEY$:IFI$="N"ORI$="n"THEN228
ELSEIFI$="y"ORI$="y"THEN138
ELSEPRINT@711,"";:FORCC=1TO58:NEXTCC:PRINT@711," ";:
PORCC=1TO58:NEXTCC:GOTO128
138 LPRINT" GRAFTRAX WORKSheet from DATAWARE by chneider" CONTROL KEYS FOR DRAWING
                                                                                                   from DATAWARE by Mark S
                                                                                            CONTROL KEYS FOR DRAWING GRAPH
 4 arrow keys......move flashing cursor around box 150 LPRINT*
 <enter> and arrow key......draw a dot and move cursor"
168 LPRINT"
  <clear> and right arrow......move cursor to upper left of next
    clear> and left arrow......move cursor to upper left of prev
 ious box"
176 LPRINT"
  <clear> and <enter>.....erase borders in this box after a
 rrival"
180 LPRINT
 <space> and right arrow.....leave a dot at the cursor, then m
ove to next box*
198 LPRINT**
  <space> and <enter>.....build file containing bit pattern
 <space> and <clear>.....build alternate file*
288 LPRINT*
  <clear> and up arrow.....begin drawing again
 <space> and up arrow.....exit program*
210 LPRINT:LPRINT:LPRINT"
After all characters have been created:
    ...move the cursor to the next box.
...Press (space) and (enter) to build the file named in line 38
3...Press <space> and <clear> to build a file with /ALT extensio
n.-
228 CLS:PRINT*Do you wish to <B>uild or <E>dit a drawing?
B or E ";

236 I$=INKEY$:IFI$="B"ORI$="b"THENMODE$="build"

ELBEFFINT@15,"";FORCE=ITO58:NEXTCC;PRINT@135," ";:
 FORCC=1T05@:NEXTCC:GOT023@
24# PRINTCHR$(27):PRINT"Name for file you wish to ";MODE$;":
       INPUTTS
"; ilrvuire
258 PRINT"
Besides ";TS; " you may also build the file ";TS; "/ALT":
FORCe=!TO896: NEXTCC
266 CLS;FORX=|8TO1185TEP18:FORY=8TO47: SET(X,Y): NEXTY,X
278 FORY=8TO49STEP8:FORX=8TO119: SET(X,Y): NEXTX, Y
228 TOY=8TO49STEP8:FORX=8TO119: SET(X,Y): NEXTX, Y
229 TOY=8TO49STEP8:FORX=8TO119: SET(X,Y): NEXTX, Y
220 TOY=8TO49STEP8:FORX=8TO49STEP8:FORX=8TO49STEP8:FORX=8TO49STEP8:FORX=8TO49STEP8:FORX=8TO49STEP8:FORX=8TO49STEP8:FORX=8TO49STEP8:FORX=8TO49STEP8:FORX=8TO49STEP8:FORX=8TO49STEP8:FORX=8TO49STEP8:FORX=8TO49STEP8:FORX=8TO49STEP8:FORX=8TO49STEP8:FORX=8TO49STEP8:FORX=8TO49STEP8:FORX=8TO49STEP8:FORX=8TO49STEP8:FORX=8TO49STEP8:FORX=8TO49STEP8:FORX=8TO49STEP8:F
           Initialize cursor (XX,YY) is upper left point of box
 298 XX=6:YY=6:X=8:Y=6:I=8:J=8
388 IPMODE$="edit"THEN2618
              Begin Loop for Keyboard Entry
 1018 X=XX+I:Y=YY+J
                                                                                                                   'increment from upper
left of box | 1828 SET(X,Y):FORCC=1TO25:NEXT:RESET(X,Y) | flash cursor | 1838 P=PEEK(14488) | read keyboar | 1848 IPP=STHEN1829 | no key press
                                                                                                                     read keyboard
                                                                                                                   'no key pressed
'begin again
 1050 IPP=10THEN140

1050 IPP=0THEN1FJ>0THENJ=J-1

1070 IPP=16THEN1FJ<7THENJ=J+1

1080 IPP=32THENIFI>0THENI=I-1
                                                                                                                     move cursor up
                                                                                                                   move cursor up
'move cursor down
'move cursor left
'move cursor right
'draw and move up
'draw and move down
'draw and move left
'draw and move reft
'draw and move row
1898 IFP=34THENIFI>8THENI=1-1
1898 IFP=64THENIFI<9THENIFI:1+1
1108 IFP=9THENIFI>8THENISET(X,Y):J=J-1
1118 IFP=17THENIFI>8THENISET(X,Y):J=J+1
1120 IFP=33THENIFI>8THENISET(X,Y):I=I-1
1130 IFP=34THENIFI<9THENISET(X,Y):I=I+1
1140 IFP=34THENIFI<28
1150 IFP=192THENIFI<9THENISET(X,Y):I=I+1
 1160 IPP=66THEN2=0:GOTO1250
1170 IPP=3THEN1290
                                                                                                                     move to next box
 1189 IFP-129THENTT$=T$:GOTO3818
1198 IFP-139THENTT$=T$+"/ALT":GOTO3818
1208 IFP-136THENCLS:END
                                                                                                                     build alternate file
                                                                                                                    'exit program
'return to begin loop
 1216 COTO1668
 1220 IFXX>0THENXX=XX-10ELSEXX=110:YY=YY-8 'back one box
```

```
Program continued
1230 IFYY<0THENYY=YY+8
                                                                              check if off screen
1248 I=8;J=8;GOTO1888 'no increment in box 1258 IFXX:118THENXX=XX+18ELSEXX=8:YY=YY+8 'next box 'check if off screen 1278 I=8:J-8:IFZ=1THENSET(X,Y) 'draw point if Z=1
                                                                             draw point if Z=1
1288 GOTO1868
1298 FORII=8T09:RESET(XX+II,YY):NEXT er.
1388 FORJJ=8T07:RESET(XX,YY+JJ):NEXT:GOTO1888
                                                                              'erase border
         Edit existing file.....first build array then print characters
2010 OPEN"I",1,T$
2020 X=0:Y=7
2030 INPUT#1,M
                                                              first character bottom left
                                                              number of characters
2948 DIMX(M,18)
2858 FORN-ITOM:FORA-ITO18
2868 INPUT#1,X(N,A)
                                                             'store binary codes
                                                             'get binary codes
2070 NEXTA N
2886 FORN=1TOM: PORNN=1TO18
2896 A=X(N,NN)
2188 FORV=7TO9STEP-1
                                                              'powers of 2
2116 U=INT(A/2(V)
2126 A=A-U+2(V
2138 IFU=ITHENSET(X,Y-
ELSERESET(X,Y-V)
                                                             binary factor?
                         NSET(X,Y-V)
                                                              'set if a factor
 2148 NEXTV
2158 X-X+1:IFX=128THENX=8:Y=Y+8 'next box 2168 MEXTHN,N 2178 CLOSE 2188 MODES="
2198 GOTO298
         Create file...first print number of characters
then build binary totals for each
character column and add to file
3616 OPEN"O",1,TTS:D=8
3626 PRINT$1,(YY/8)*12+XX/16
3636 PORA=7TOYY+7STEP8
3646 PORE=8TO119
3658 PORC=8TO7
                                                              '# of characters
                                                              'increment row
                                                              'increment rows
'move along botom of boxes
'move up each column of charact
ers
3668 IPPOINT(B,A-C) THEND=D+2[C
                                                             'if point set, increment by tha
3868 IPPOINT(B,A-C)
t power of 2
3878 NEXTC
3888 L(B)=D
3898 D=B
3188 NEXTB
3118 PORH=8TO119
3128 PRINT#1,L(H);
row to file
3138 NEXTH,A
3148 CLOSE
                                                             'build array for each row
'reset binary counter
                                                             'add binary bit totals for this
 3140 CLOSE
3150 GOTO1030
                                                             'back to loop
```

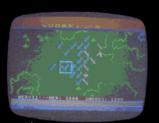
```
166 '
        Sample program to read in file of bit column codes and store them in array T( character # , column #)
118 CLS:INPUT"Name of file containing bit graphics",R$ 128 CLS 138 OPEN"I",1,B$
                                           'M is # of characters
'M characters , 10 columns per characte
140 INPUT#1,M
150 DIMT(M,10)
168 FORA=1TOM
178 FORAA=1TO18
188 INPUT#1,T(A,AA)
                                           'increment characters
'increment columns
                                            'read binary bit total for each column
196 NEXTAA
200 NEXTA
210 CLOSE
        Print characters by calling a subroutine W = 2 prints each column twice for double width
 318 FORW=1TO2
                                                 'once normal, then double width
328 PORM=27TO1STEP-1:GOSUB418:NEXTA:
LPRINT is the Hebrew alphabet."
338 LPRINT
        PRINTT
Thank you very much.....";:
A=5:GOSUB480:A=2:GOSUB480:A=25:GOSUB480:
LPRINTSTRINGS(W,32);:
A=5:GOSUB480:A=4:GOSUB480:A=6:GOSUB480:A~27:GOSUB480
340 LPRINT
        Peace be upon you......;;

A=15:GOSUB488;A=11:GOSUB488:A=18:GOSUB488;

A=13:GOSUB488:A=19:GOSUB488:LPRINTSTRING$(W,32);;

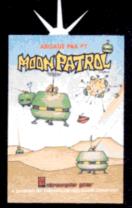
A=15:GOSUB488:LPRINT:LPRINT:LPRINT
350 NEXTW
 400
              Subroutine to print a bit-plot graphic character
                                              'set printer to bit graphics mode
'W columns per character
'second argument 0 since fewer than 25
 410 LPRINTCHRS(27) "L";
 428 PORE14312,W*10
438 LPRINTCHR$(255);
 6 columns
446 PORAA=1TO18
                                             '10 columns per character
'poke binary total to printer port
450 PORE14312,T(A,AA)
460 IFW-2
        THENPOKE14312, T(A, AA) 'if double width then repeat
479 NEXTAA
488 RETURN
                              Program Listing 2. Read File
```

Program continues

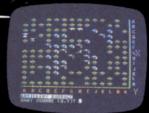




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LPRINT CHR\$(27)"L"; CHR\$(1); : POKE 14312.0 : LPRINT CHR\$(255). My program POKEs all values to 14312 to avoid these problems.

#### **Bit-Graphic File**

The first program sketches a giant model of each character desired. Using the arrow keys, space, Enter, and Clear in various combinations, you can move the cursor within each character, draw lines and dots, and move to a new box. Memory location 14400 scans all these kevs: by PEEKing this location. the keys, individually or in combination, are sensed.

To fit as many characters on the screen as possible, the border lines are part of the character box. As the cursor moves to each box, erase the border lines by entering and clearing to avoid interference. Also to save space, the instructions are produced on the printer. When forming characters, decide whether to draw a dot where the cursor sits before moving it to the next box. Pressing Clear and right arrow does not draw a dot before moving, while pressing space and right arrow leaves a dot (see lines 1150, 1160, 1270).

When the characters are complete (see Fig. 2), a scanning routine determines the bit-plot codes and prints them out to a disk file. Sometimes you cannot decide on the best form for a letter by looking at a giant model; an option builds two files. The file name asked for at the beginning of the program is used if you press space and Enter. Then modify the drawing and save an alternate version by pressing space and Clear. This file has the same name and /ALT as an extension (lines 1180, 1190), You can edit from one file and save the revised version to the alternate file.

The file building portion of the program (lines 3000-3140) writes the number of characters to the file. Then the program scans the screen one line at a time, and computes the binary bit code for each column (lines 3030-3100). Because the Point command works rather slowly, the disk spins for several minutes if each code is written as it is computed. By storing the codes in an array (line 3080), an entire line of 12 characters is written to disk at once (lines 3110-3130).

#### **Bit-Plot Graphic Characters**

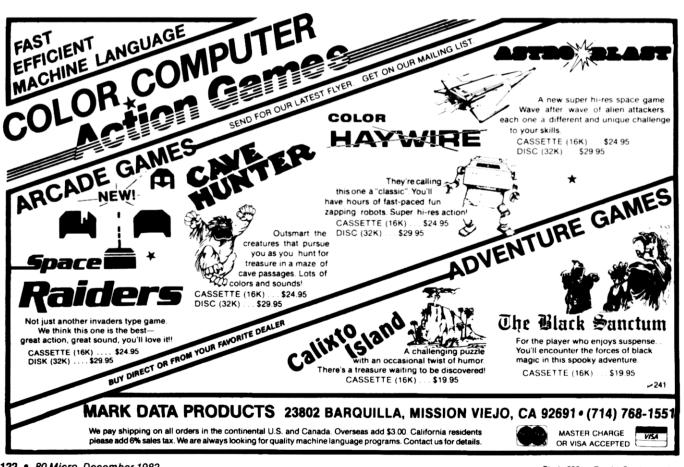
The second program reads the file created in the first program to build an array containing the 10 column bit codes for each character (lines 160-200). A subroutine at lines 410-470 prints each character. The calling sequence is as I stated at the beginning of this article: control L, and two arguments sent to the printer. The first argument is POKEd, as

it may be 10. The second should be a zero, but since you cannot LPRINT CHR\$(0), the printer allows substituting CHR\$(255) for CHR\$(0). You could also POKE this value to the printer port. The variable W (lines 310, 420, 460) allows double width letters by printing each column twice. You could form triple-size letters similarly, although they would look grotesque.

The sample printing routines (lines 310-350) demonstrate ways to call the subroutine. First, every character is printed (here in reverse order, as Hebrew is read from right to left); then selected letters are chosen using the number order in which they were read from the disk (see Fig. 2).■

אבידהו וחטיבר לפסגן סעפרצ אקרשת is the Hebrew alphabet. חודה רבה..... Thank you very much..... Peace be upon you........... ווסעפפע אקרשח is the Hebrew alphabet. Thank you very much...... Peace be upon you......ロコ・マン・ロリマロ

Fig. 2. Sample Printout





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## Forms Cleanup

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he current Model II Disk Operating System (TRSDOS

> The Key Box Model II Basic 64K RAM Model II TRSDOS 2.0a One Disk Drive Printer required

2.0a) contains a commonly used library command called Forms. Forms initializes the printerdriver software, and skips a preset number of lines after a specified number of lines have been printed.

A printer-driver initialization such as Forms should always be executed immediately before printing a report to ensure that the printer starts at the top of Forms. Unfortunately, Forms automatically prints a series of messages on the screen which the operator must answer in a specific manner.

Aside from messing up an

otherwise meticulous screen presentation, the Forms messages can confuse the operator. Fortunately, there is a much simpler way of performing the required initialization function while also eliminating Forms' drawbacks.

#### FRMS

FRMS is a short machine-language program that allows you to set the number of printed lines on a page and maximum characters per line (the maximum page length is preset at 66). FRMS is simple to use and completely eliminates the annoying and sometimes confusing Forms messages. No operator intervention is required to use FRMS. Since FRMS acts instantaneously, the operator has no indication that a Forms Set is required or being performed.

FRMS initializes the printerdriver parameters indicated above but does not check the printer's status. The line printer need not be on-line when FRMS is executed. Before you can use FRMS, you must perform three one-time tasks:

- Create the machine language program (FRMS).
- Save the created program on disk.
- •Incorporate the necessary

Basic statements in the target Basic program.

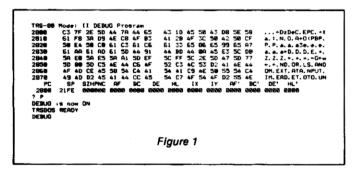
#### Creating the Program

We will use Debug (see pages 86-92 of the TRS-80 Model II Disk Operating System Reference Manual) to place the program into memory. Begin by starting up the Model II with a System disk. After entering the date (required) and time (optional) you will be in the TRSDOS Ready mode (unless the disk contains an auto startup procedure. If you automatically enter Basic, simply type SYSTEM and press enter and you will return to the TRSDOS Ready mode).

Enter Debug On and then enter Debug. The screen will appear similar to Fig. 1. Press M (to examine and change memory). The question mark prompt on the screen will be replaced with "M A = ...". Type F000. The first line on the screen will be similar to Fig. 2. Now press the F1 key. The cursor will move to the first displayed number on the F000 line. Type in the following 18 characters exactly (do *not* press enter or the space bar):

56234E06083E11CFC9

Review the screen. If any 80 Micro, December 1982 • 125



character is incorrect, use the right or left arrow keys as necessary to position the cursor over the incorrect character. Then retype the correct character. When all characters are correct, press the F2 key to enter this program into memory. Now press O (not zero) to turn Debug off. The FRMS program is now stored in memory. (This is a demonstration version which we will change later.)

#### Saving the Program

Next we will use the library utility Dump (see page 102 of the TRSDOS manual). Enter DUMP FRMS (START = F000, END=F008). After some time, you will see "TRSDOS Ready." Type DIR and press enter. Your directory listing will now include a new file named FRMS.

#### Using FRMS in a Basic Program

Type BASIC and press enter. When you see Ready, type AUTO and press enter and then enter the program shown in Listing 1.

Enter SAVE"FRMSTST". Af-

ter the test program has been saved and you have turned on your printer and put it on line, run the program. Enter 2 as the number of lines, and 3 as the number of characters per line. Enter 123456789 as the test line. Your printed output will show:

123 456

789

Now enter 2 as the number of lines and 9 as the number of characters per line. Again, enter 123456789 as the test line. Your printed output will now be:

123456789

No top of form was performed as before.

Now that we know the FRMS program is working properly, we must modify it. When we performed the first test above, six blank lines were printed be-

tween the 456 and 789 because we set our page length at eight lines for demonstration purposes. We will now use Debug to modify FRMS for a 66-line page length.

#### Changing the Demo

Enter SYSTEM to return to the TRSDOS Ready mode. Type DEBUG ON and press enter and then type DEBUG and press enter. Type MF004 to go to the memory location of the byte that must be changed. Press F1 to move the cursor to the F004 presentation line. Now type 42 (since 66 decimal equals 42 hex) and then press the F2 key to store the modified information into memory. Press O (not zero) to turn Debug off. Finally, enter DUMP FRMS{START = F000,END = F008) to save the modified FRMS program.

#### Using FRMS in Your Basic Programs

You may use the current version of FRMS in any Basic program that does not require the use of any TRSDOS high memory modules or other machine-language programs. If this is a requirement of your Basic program, I will discuss later how to

relocate FRMS and reserve a memory area for it.

The FRMS program must be on the same disk as the Basic program which will use it. Use the TRSDOS library command Move (see pages 120–121 of the DOS Reference Manual) to move FRMS to the disk which will contain the Basic program.

Next, you must select three variables (one must be an integer variable) that will not be used in the remainder of your Basic program. Our demonstration program used FL, FC and A%, but you can use any variables. As an example, we will specify Z1%, ZL and ZC.

The first required statement for your Basic program is DEFUSR0 = &HF000 (the "zero" in DEFUSR0 is optional). This should appear early in your program. This statement tells the computer that you plan to call a machine-language program using the command X = USR0 (variable), and that this machinelanguage program will reside in memory starting at location F000 hex (the "zero" in USR0 is also optional). Next, load this program into memory. The Basic program must include SYSTEM "LOAD FRMS". This statement

# Color Compute



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80 M

10	DEFUSH = &HF000:ON ERROR GOTO 90
20	SYSTEM"LOAD FRMS"
30	INPUT"Enter Number of Lines per Page "FI

- 40 INPUT"Enter Number of Characters/Line..";FC 50 A% = FL\*256 + FC
- 60 X = USR(A%)
- 70 PRINT:LINE INPUT"Enter Test Line for Printing...";TL\$
- 80 LPRINT TL\$:PRINT:PRINT:GOTO 30
- 90 RESUME 30
- 100 (press the break key when 100 appears).

Program Listing 1. Demonstration program

	00010	:		
	00020	:	UTILITY	PROGRAM # 1
	00030		NAME: F	
	00040	,	PROGRAM	MER: J. BARBARELLO
	00050		LATEST	UPDATE: # 0, 6 NOV 1981
	00060	;		
	00070	LABST	RACT: This	Program obtains the # char, per
	20050	11:54	CION Orde	r byte into register D) and the
	00090	10 101	es per pa	ge thigh order byte into register ()
	00100	tfrom	the BASIC	program using USR (or USRO). It the
	00110	iperfo	orms a FOR	MS SET without the annoying prompts
	00120	tthat	must be a	nswered by the operator. Maximum
	00130	11 ines	s per page	(resister B) is preset at 66.
	00140	t		
000	00150	ORG	0F000H	:PROGRAM STARTS AT 61440 DECIMAL
<b>2000</b> 5€	00160	LD	D <sub>1</sub> (HL)	:# CHAR/LINE>D (LOW ORDER BYTE)
<b>001</b> 23	00170	INC.	HL.	POINT TO NEXT MEMORY ADDRESS
002 4E	00180	LD	C. (HL)	*# LINES/PAGE>C (HIGH ORDER BYTE)
003 0642	00190	LD	B, 6E	:66 LINES PER PAGE
005 3E11	ØØ2@Ø	LD	A. 17	:SVC # 17 (PRINTER INITIALIZATION)
007 CF	00210	RST	3	:EXECUTE SVC # 17
		RET		RETURN TO BASIC PROGRAM
1 <b>00</b> 8 C9	00220	ME I		THE TURN TO BHSIC PROGRAM

Program Listing 2. Assembly language version of FRMS

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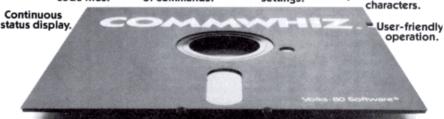
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need only be executed once. Locate it immediately after the DEFUSR command. An early program line such as 20 DEFUSR = &HF000: SYSTEM"LOAD FRMS" would be perfect. Next, create a subroutine to access the FRMS function. It can begin at any line. I suggest the sample routine in Program Listing 3.

Then at any point in the program, you can perform the FRMS function by simply identifying the number of lines per page (ZL), the maximum characters per line (ZC) and performing a GOSUB 60000. An example is shown in Program Listing 4.

To use FRMS you must perform these four steps:

- Include the FRMS program on your Basic program disk.
- ●Include DEFUSR = &HF000: SYSTEM"LOAD FRMS" as a program line.
- •Include the machine lanquage Forms Set subroutine as shown in Listing 3 in your Basic program.
- Specify ZL and ZC. Then GOSUB 60000 (Forms Set subroutine).

If you require a page length other than 66 lines, you can modify FRMS as we did above. For instance, you could change the 42 at memory locations F004-F005 to 3C (3C hex equals 60 decimal. This sets page length to 60 lines). After saving this modified version (call it FRMS60) using the Dump command, use "SYSTEM"LOAD FRMS60"" in your Basic program to load the correct version.

#### **Relocating FRMS**

In the normal Basic mode, memory top is set at EFFF hex. This leaves the memory from F000-F800 free for TRSDOS high memory and other machine-language programs without having to set user memory (F801-FFFF is the screen memory area). However, you may reserve extra memory upon entry into Basic and avoid any chance of memory conflict. To show this, I will relocate FRMS so that it loads into a protected memory area. Follow these steps:

- Start up the computer with a System disk containing FRMS.
- When "TRSDOS Ready" appears, type LOAD FRMS and press enter.
- Enter DUMP FRMSP (START = F000, END = F008, RELO =
- Type DIR and press enter. Note you have a new directory entry (FRMSP).
- Enter AUTO BASIC xxxxxxxx/ yyy -F:n -M:61429 < E> where xxxxxxxx/yyy is the name of a Basic program you wish to load and run automatically upon startup (this is optional. If not needed, leave one space after Basic); n is the number of disk file buffers you want available (this is also optional).
- Replace DEFUSR = &HF000: SYSTEM "LOAD FRMS" in your Basic program with DEFUSR = & HEFF6: SYSTEM"LOAD FRMSP" (P means protected). ■

Jim Barbarello is employed by the US Army Communications Electronics Command. His hobbies are music and woodworking.

60000 REM\*\* MACHINE LANGUAGE FORMS SET SUBROUTINE \*\*

60010 Z1% = ZL . 256 + ZC

60020 ZC = USR(Z1%):RETURN

Program Listing 3. Forms Set subroutine

4123 ZL = 60:ZC = 132:GOSUB 60000:REM \*\* 60 L/P,132 C/L CHOSEN \*\*

4124 GOSUB 5000:REM\*\* PRINT REPORT # 1 \*

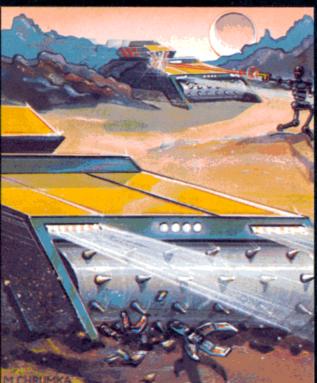
ZL = 60:ZC = 80:GOSUB 60000:REM\*\* TOP OF PAGE RESET.80 C/L \*\* 4125

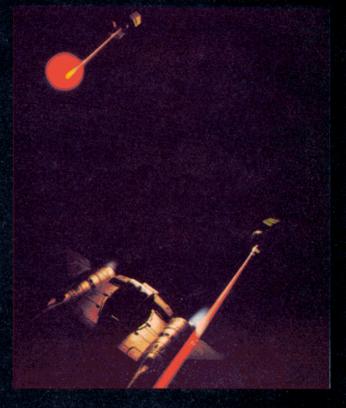
GOSUB 60000: REM \*\* PRINT REPORT # 2 4126

etc

Program Listing 4







CYBORG A TRS-80 Classic by Bill Dunlevy and Doug Frayer. "Incredible graphics", The screen slides smoothly in all directions. "Mind boggling speed" put your Anti Grav sled in fourth and you will see what fast graphics are. This is not a worked over arcade game: it is something totally new. This game has more new features then any arcade game ever written for the TRS-80.

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## Inside Scripsit—Part III

by Craig A. Lindley

ree your CPU from slow peripherals! Use your knowledge of the features and functions of Scripsit to write a spooler/despooler program.

In the first two articles in this series I showed how Scripsit was internally constructed and how to modify it to add features and functions to enhance its operation. In this part I will show you how to write a spooler/despooler

that frees your computer from printing so it can accomplish other tasks.

Spool stands for simultaneous peripheral output overlap. This technique is used in large computer systems to increase throughput. It frees the

tined for the peripheral device is sent either to memory or a storage medium (spooled) until the peripheral device is ready for it. The data is then transferred to the peripheral device (despooled) as it is required at the rate that the device can accept it. By doing this, the CPU is free to process other higher priority tasks. In the TRS-80, the CPU can run other programs while the despooler is outputting characters to the line printer during the 25-microsecond interrupt time. The despooler is termed a foreground task because it operates during interrupt time. The program that is running (and interrupted by the de-

CPU from driving a slow peripheral device such as a printer. The data des-

The Scripsit Spooler/Despooler consists of two programs. I didn't want to add any additional features to the Scripsit modification program presented in the last article because it would reduce the text buffer area. In-

spooler) is called the background task.

		Prograi	m Listing 1. Spooler	
	88188 ;***	*******	************	*****
	00110 ;***	PRI	NT SPOOLER UTILITY	***
	00120 :***		IT FILE SPOOLER VI.	g ***
	00130 ;***		OVEMBER 11, 1981	***
	00140 ;***		BY	***
	00150 ;***		RAIG A. LINDLEY	***
	99169 ;***		************	******
	00170 :			
	00180 ;***	*****		
	00190 ;SYS		ES	
	00200 ;***	******		
	00210 ;			
0033	00220 CHRO		0033H	; CHAR OUT ROUTINE
4428	00230 CLOS		4428H	CLOSE FILE ROUTINE
Ø1C9	00240 CLRS		Ø1C9H	;CLEAR SCREEN ROUTINE
4020	00250 CURS		4020H	; CURSOR ADDR STORAGE
0060	00260 DELA		0060H	; DELAY ROUTINE
4409	00270 ERRO		4409H	; DOS ERROR OUT ROUTINE
4420	00280 INIT		4420H	; INITIALIZE DISK FILE
0049	00290 KEYI		0049H	;KEYIN ROUTINE
442C	00300 KILL		442CH	;KILL DISK FILE
4430	00310 LOAD		4430H	;LOAD CMD FILE ROUTINE
FCFF	00320 MEMS	IZ EQU	ØFCFFH	; DESPOOLER MEMORY
	00330			; PROTECT LIMIT
6BC8	00340 OPCM		6BC8H	; SCRIPSIT OUT MSG ROUTIN
402D	00350 OPSY		402DH	; REENTER OP SYSTEM
441C	00360 PARS		441CH	; PARSE FILESPEC ROUTINE
002B	00370 SCAN	EQU	002BH	; SCAN KEYS ROM ROUTINE
523F		EQU		SCRIPSIT ENTRY POINT
4439	00390 WRIT	E EQU	4439H	;DOS WRITE DISK FILE
	00400 ;			
7 <b>A</b> A6	00410 00420 :	ORG	7AA6H	

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stead I developed a new modification program for Scripsit with only the spool and underline functions added. I do all the text entry and editing with the modification program presented in the second article. This new modification program spools the printed result.

I had to implement the underline function in the spooler modification program so you can spool files that incorporate this feature. If you want to perform word processing while despooling you must also use this new program (without all of the enhancements) because the unmodified Scripsit program and the patch program presented in the last article turn off the interrupts, thereby stopping the despooling process.

#### **Spooler Operation**

The spooler program is shown in Program Listing 1. Execute the program as a DOS command file by entering SSPOOL. The program's execution begins at the label Start shown on the listing. When executed, the screen clears, the sign-on message is displayed and the file SCRIPSIT/LC is located and loaded. If you use only the uppercase version of the Scripsit program, change the file extension on line 500 of Listing 1 to /UC, for proper operation of this program.

After Scripsit is loaded, it is patched extensively to allow the spool program to function correctly. All three places in the Scripsit program that read the status of the parallel printer are patched with the following code:

LD A,30H ;Printer ready status NOP ;Fill empty byte

so the printer always appears ready to the Scripsit program.

All five places in the Scripsit program that output a byte in the A register to the printer are patched with the following code:

CALL SPOOL ; Call Spooler subroutine

so the spooler program receives all printed output from the Scripsit program. The End routine is modified so it jumps to the CSPOOL routine, which closes the spool file before you leave Scripsit. After the spool file is closed, you are returned to DOS instead of the reboot in the standard Scripsit program. Four other important patches are applied to the memory resident Scripsit program to make it compatible with the despooler program:

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SEA DRAGON could be the best ever from Adventure International. Sea Dragon is something like Penetrator but based on a underwater theme. Great graphics, good sound and good action make this game a must (19.95/24.95)

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envent into white the standard Meet,

```
Listing 1 continued
                 00430 ;*******
                 00440 ; SYSTEM STORAGE LOCATIONS
                 00450
                 00460
7AA6 CA7A
                 00470 BUFPTR
                                  DEFW
                                           DISKIO+1
                                                              ;PTR TO SPOOL DATA BUFFER
                 99489 COUNT
7AA8 01
                                  DEFB
                                                              ;DATA BUFFER CHAR COUNT
                 00490
                 00500 DCB
                                                              :FILE DCB
7AA9 53
                                 DEFM
                                           'SCRIPSIT/LC'
7AB4
                 00510
                                 DEFB
                 00520
00530
0014
                                 DEFS
                                           20
                 00540 DISKIO
ØØFF
                                 DEFS
                                                              :DISK I/O BUFFER
                 00550
                        FNAME
7BC8 50
                 00560
                                  DEFM
                                            'PRT1/DAT:0'
                                                              :SPOOL FILE NAME
7BD2 0D
                 00570
                                  DEFB
7BD3 ØØ
                 00580
                                 DEFB
                 00590 ;
00600 IN
7BD4 3E
                                 DEFR
                                           3EH
                                                              :STATUS IN PATCH DATA
7BD5
                                           3 Ø H
                                  DEFB
7 BD6
      00
                 00620
                                 DEFB
                 00630
7BD7 21
                 00640 MEM
                                  DEFB
                                                              ; LOAD MEMORY LIMIT
                                           MEMSIZ+256
7BD8 FFFD
                 00650
                                 DEFW
                                                              INSTRUCTIONS
                 00660
7BDA CD
                 00670
                        OUT
                                 DEFR
                                           OCDH
                                                               PRINT OUT PATCH DATA
7BDB 8E7F
                 00680
                                           SPOOL
                                  DEFW
                 00690
 7BDD 00
                 99799
                        UNDFIG
                                  DEFR
                                                              ; UNDERLINE FLAG
 7BDE ØE
                        UNDOFF
                                  DEFB
                                                               TURN UNDERLINE OFF
                 00720 UNDON
00730 ;
7BDF ØF
                                           15
                                  DEFB
                                                              TURN UNDERLINE ON
7BEØ 10
7BE1 44
                 00740
                        EMSG2
                                  DEFB
                                                               ; MSG LENGTH
                 00750
                                  DEFM
                                            'DISK I/O ERROR !
                 00760
7F62
                 00770
                                 ORG
                                           7F62H
                 00790
                 00800
                        CLOSE SPOOL FILE ROUTINE
                 00810
                 00820
7F62 3AA87A
7F65 B7
                        CSPOOL
                                  LD
                                           A, (COUNT)
                                                              GET DATA COUNT
                                                              ;IS IT ZERO ?
;IF YES, CLOSE FILE
;FIND REMAINING AREA
                 00840
                                 OR
7F66 2811
7F68 2F
                                  JR
                                           Z.CFILE
                 99869
                                  CPL
                 00870
                                 INC
                                                              ;TRUE COUNT
;INTO "B"
7F6A 47
7F6B 2AA67A
                                 LD
                 94889
                 00890
                                           HL, (BUFPTR)
                                                              GET BUFFER DATA PTR
7F6E 3600
7F70 23
                 00900
                       FILL
                                  LD
                                           (HL),0
                                                              :STORE INTO BUFFER
                 00910
                                 INC
7F71 10FB
                                 DJNZ
                                           FILI
                                                              :FILL REST OF BUFFER
                 00930
                 00940
                        ; WRITE LAST DISK RECORD
                 00950
7F73 11A97A
                 00960
                                 LD
                                           DE.DCB
                                                              PT AT DCB
7F76 CD3944
                                 CALL
                                           WRITE
                 00980
                        NOW CLOSE THE FILE
                 01000
                 01010 CFILE
7F79 CDC901
                                 CALL
                                           CLRSCN
                                                              CLEAR SCREEN
7F7C 11A97A
7F7F CD2844
                 01020
                                 LD
                                           DE, DCB
                                                              ;FILE DCB
                 01030
                                 CALL
                                           CLOSE
7F82 C32D40
                                 JP
                                                              ; BACK TO DOS
                                           OPSYS
                 01050
                 01060
                 01070
                        KEYMOD ROUTINE - CAUSES SCRIPSIT TO POLL THE KEYBOARD
                 01080 ; IN THE NORMAL MANNER PERIODICALLY FOR THE DESPOOLER.
                 01100
7F85 CD2B00
                        KEYMOD
                                 CALL
                                           SCAN
                                                              POLL KEYS
7F88 110004
                                           DE,400H
                 01120
                                 LD
JP
                                                              ; RESTORE OVERLAID
7F8B C3EB5F
                                           5FEBH
                                                              CODE
                 01140
                01160
01170
                       ; SPOOLER ROUTINE
                01180
7F8E E5
                01190 SPOOL
                                 PUSH
                                                             ; SAVE REGISTERS
7F8F D5
                                 PUSH
                                           DE
7F90 F5
                01210
                                 PUSH
                                                             : SAVE CHAR
7F91 2AA67A
                01220
                                 LD
                                           HL, (BUFPTR)
                                                              ; LOAD PTR TO BUFFER
7F94 77
7F95 23
                01230
                                 LD
                                           (HL),A
                                                              STORE PRINT CHAR
                Ø124Ø
Ø125Ø
                                 INC
                                                              BUMP PTR
7F96 22A67A
                                           (BUFPTR),HL
                                                              STORE UPDATED VALUE
GET BUF CHAR COUNT
(CP -1) BUF FULL
                                 LD
7F99 3AA87A
7F9C FEFF
                01260
01270
                                          A, (COUNT)
                                 LD
CP
                                                                          BUF FULL ?
7F9E 2808
                01280
                                 JR
                                           Z, TODISK
                                                              IF PULL THEN
7FAØ 3C
7FA1 32A87A
                01290
01300
                                                              ;BUMP COUNTER
;STORE UPDATED COUNT
                                 INC
                                           (COUNT),A
                                 LD
7FA4 F1
                01310 GONE
                                 POP
                                                              RESTORE CHAR
7FA5 D1
                                           DE
                                 POP
                                                              RESTORE REGISTERS
7FA6 E1
7FA7 C9
                01330
01340
                                 POP
                                 RET
                01350
01360
                       ; IF DISK BUFFER IS FULL - WRITE TO DISK
                01370
7FA8 11A97A
                                                              ;FILE DCB
                01380
                       TODISK
                                 LD
                                           DE.DCB
     CD3944
                                 CALL
                                                              SCRIPSIT WRITE TO DISK
                                           WRITE
7FAE 2812
                01400
                                 JR
LD
                                                              ; IF WRITE OK THEN
                                           Z,TOD1
     21EØ7B
                01410
                                           HL.EMSG2
                                                              DISK ERROR MSG
                01420
01430
7FB3 CDC86B
                                 CALL
                                                              OUT MSG ON CMD LINE
                                           OPCMDL
7FB6 010000
                                 LD
                                           BC. Ø
7FB9 CD6000
                                 CALL
                                           DELAY
                                                              :WAIT FOR VIEW
7FBC 31FC41
                                           SP.41FCH
                                                              STACK PTR
                                                                             Listing 1 continues
```

- The disable-interrupt instruction located at 52C0H is overlayed with a NOP instruction to allow interrupts to be serviced during Scripsit's operation.
- A call is made to the ROM key scan routine at 2BH to couple the Scripsit program to the despooler program as required.
- The Debug vector at 4315H is cleared to prevent Debug from being entered when the break key is pressed.
- Scripsit's memory-size routine is patched to protect the despooler in high memory.

These four patches allow this Scripsit patch program to operate during the despooling process.

After all these patches are made, you will be asked the following three questions:

- 1) CREATE SPOOL FILE ON DRIVE (0\*-3): ?
- 2) NUMBER OF COPIES (1\*-9): ?
- 3) ARE THESE CORRECT (Y\*/N): ?

The default answers are shown marked with the asterisk and are chosen by pressing enter. If you want to create the spool file on drive 0 and want just one copy of the spool file, press enter three times.

The answer to the first question determines on which drive the spool file will be stored. Spool files can be rather large so place them on a disk with a lot of free space. The default file name is: PRT1/DAT. This file will be created on the specified disk drive unless a file by that name already exists. If a file does exit, the next higher version-numbered file will be created, for example: PRT2/DAT. This version-number advancing process continues until the program determines that a new file has been created. This process prevents the spooler from overwriting an existing spool file. In any case, the program displays the filespec of the created spool file.

Your answer to the next question determines how many copies of the complete spool file will be printed by the despooler. The default is one copy, but you can generate up to nine copies. The despooler has the logic needed to print the specified number of copies requested. The final question is a verification of the previously input data. If you answer with anything besides N, you will be immediately transferred to a fully initialized and operational Scripsit program. If you answer N, you will be asked the questions again.

While in Scripsit you can use all of the commands available in the unmodified program with the addition of the

underline feature. When you try to print a document, the printer will remain silent and the disk drives will run. Use the normal Load command to load the Scripsit files you want to spool and then use the Print command to spool them. You can spool as many documents as the disk space allows; you are not limited to one Scripsit document per spool file. For example, if you spool two different documents and had requested two copies of the spool file earlier, you will receive four documents. When you are finished spooling your documents, type End as you normally would and you will be returned to the operating system as usual.

#### **Despool Operation**

Enter despool to execute the despooler. You will be asked, "FILE: ?" which is your cue to input the filespec of the spool file you wish to despool. Press enter to use the default filespec: PRT1/DAT. The despooler program will search the active disk drives in your system for this file. The first file found with this name will be despooled. To specify a different filespec, just type it in and press enter. If the file you specified is found, it will be despooled. If not, you will be told so. After the file is found, the program shows you how many copies of the spool file you requested when it was spooled and then returns to the operating system. Then the printer will start and you will be free to do other tasks. You can run any programs that you wish, including Basic, as long as the interrupts are not disabled. If the interrupts are disabled and then turned back on again, you will not lose any printed data, but the printer will be silent for the duration that the interrupts were off.

Following are several points to remember about the despooler program's operation.

Do not reboot your computer while the despooler is printing. If you do, you will have to restart despooling of the spool file.

Do not try to print anything in the conventional manner while the despooler is operational. This will result in a mix of the despooled and the real-time print data. You can, however, spool additional Scripsit files while the despooler is operational.

During the time the despooler reads the disk, the keyboard will become momentarily disabled. Care must be taken to prevent characters you type from being lost during these times.

While the despooler is active, an as-

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8M

```
Listing 1 continued
 7FBF C34752
                  01460
                                    JP
                                              5247H
                                                                   :START OVER
                  01470
01480
                          TOD1
                                    LD
                                                                   ; I/O BUFFER
; INITIALIZE PTR AGAIN
                                              HL.DISKIO
 7FC5 22A67A
                                    LD
                                              (BUFPTR),HL
 7FC8 AF
                   01500
                                    XOR
                                                                   CLEAR "A"
      32A87A
                   Ø151@
                                              (COUNT),A
                                    LD
                                                                   : COUNT=0
 7FCC 18D6
                  01520
01530
                                                                   : END
                   01540
                  01550 ;UNDERLINE ON/OFF ROUTINE 01560 ;********
                   01570
 7FCE E5
                   01580
                          UNDRLN
                                    PUSH
                                                                   SAVE REG
7FCF FE40
7FD1 2015
                  01590
01600
                                                                   ; @ ?
; IF NOT THEN
; GET UNDERLINE FLAG
                                    JR
                                              NZ,UN2
 7FD3 21DD7B
7FD6 CB46
                                              HL, UNDFLG
                   01620
                                    BIT
                                              0,(HL)
                                                                   ; IS FUNCTION ON ?
 7FD8 2808
                   01630
                                    JR
                                              Z.UN1
                                                                   ; IF NOT THEN
; IF ON - TURN OFF
 7FDA CB86
                  01640
01650
                                    RES
                                              0,(HL)
7FDC 21DE7B
7FDF 7E
                                              HL, UNDOFF
A, (HL)
                                    LD
                                                                    PT AT UNDERLINE OFF CODE
                  01660
                                                                   GET FUNCTION CHAR
 7FEØ 1806
                  01670
                                    JR
                                              UN2
7FE2 CBC6
7FE4 21DF7B
                   01680 UN1
                                    SET
                                              0,(HL)
                                                                   ; IF OFF - TURN ON
                  01690
01700
                                    LD
                                              HL, UNDON
                                                                   ;PT AT UNDERLINE ON CODE
                                    LD
                                              A, (HL)
                                                                   GET FUNCTION CHAR
                  01710 UN2
01720
7FE8 CD8E7F
                                    CALL
                                              SPOOL
                                                                   CUTPUT NORMAL CHAR TO
                                                                   THE SPOOL FILE
7FEB E1
7FEC C3745F
                  Ø173Ø
                                    POP
                                                                   RESTORE REG
                  01740
                                              5F74H
                                                                   BACK TO SCRIPSIT
                  01750 ;
                  01760
                           ********
                  01770 ;THIS ROUTINE CHECKS EACH VIDEO OUTPUT CHAR TO SEE IF 01780 ;IT IS AN @ CHAR. IF IT IS THE VIDEO IS SENT AN 01790 ;UNDERSCORE CHAR INSTEAD.
                  01800 ;
                  01810
7FEF FE40
                                                                  ; @ CHAR ?
; IF NOT THEN
; BACK UP CURSOR
; REPLACE CHAR
                  01820 VUNDRI.
                                    CP
                                              40H
7FF1 2004
7FF3 2B
                                    JR
                                              NZ,VUl
                                              HL
(HL),5PH
                  01840
                                    DEC
7FF4 365F
7FF6 23
                                    LD
                                    INC
                  01860
7FF7 FD3406
                                              (IY+6)
                         VUl
7FFA C3B25F
                  Ø188Ø
                  01890
                  01900
                  0:910
                         SYSTEM MESSAGES
                  01930
7FFD 593C
                  01940 MSG1
                                    DEFW
                                              3C59H
7FFF 54
800E 03
                  Ø195Ø
                                    DEFM
                                              TRS-80 MODEL I'
                  01960
                                    DEFR
800F 953C
                  01970 MSG2
                                              3C95H
                                    DEFW
                  01980
01990
8011 53
                                    DEFM
                                               SCRIPSIT FILE SPOOLER'
8028 ØD
                                              13
                                    DEFB
8029 03
                  02000
                                    DEFB
802A DE3C
                  02010
                                    DEFW
                                              3CDEH
                  02020
                                    DEFM
                                              'V1.0
8030 03
8031 4D3F
8033 43
                  02030
02040
                                    DEFW
                                              3FADH
                  02050
                                    DEFM
                                               COPYRIGHT (C) 1981 BY CRAIG A. LINDLEY'
8059 03
                  02060
                                    DEFR
805A 873F
805C 2A
                  02070
                                    DEFW
                  02080
                                                   UNAUTHORIZED DUPLICATION IS
807B 50
                  02090
                                              PROHIBITED BY LAW **
                                    DEFM
                  02100
02110
808F 00
                                    DEFB
8090 0D
                  02120 MSG3
                                    DEFB
8091 43
80B4 00
                  02130
02140
                                              'CREATE SPOOL FILE ON DRIVE (0*-3): '
                                    DEFB
                  02150
8ØB5 ØD
                  02160 MSG4
                                    DEFR
80B6 43
80C5 00
                  02170
                                              'CREATING FILE: '
                                    DEFM
                  02180
                                    DEFE
80C6 0D
80C7 4E
                  02200 MSG5
                                    DEFB
                  02210
                                   DEFM
                                              'NUMBER OF COPIES (1*-9): '
30E0 00
                  02220
                                    DEFB
                  02230
80E1 0D
80E2 41
80FC 00
                  02240 MSG6
                                   DEFB
                                             'ARE THESE CORRECT (Y*/N): '
                  02250
02260
                                   DEFR
                  02270
                  02280 MSG7
                                   DEFM
                                              *** SCRIPSIT SPOOLER PROGRAM ** '
811D 42
                  02290
                                   DEFM
                                              'BY CRAIG A. LINDLEY
                 02300
                  02310
                  02320
                         ;SYSTEM ERROR MESSAGES
                  #233#
8130 0D
8131 2A
                                   DEFB
                                              13
'** SCRIPSIT PROGRAM NOT FOUND **'
                  02350
                         EMSG1
                  02360
                                   DEFM
8151 ØD
                 02370
02380
                                   DEFB
                                   DEFR
                 02390
                 02409
                         ; PROGRAM SUBROUTINES
                 02420
                 02430
                         ; INSTRUCTION MOVE ROUTINE
                  02450
                  02460 INSMV
                                   PUSH
                                                                  :SAVE INSTRUCTION PTR
8154 010300
                                                                  BYTES TO MOVE
8157 EDB@
                 02480
                                   LDIR
                                                                  MOVE IT
                                                                                  Listing 1 continues
```

terisk will blink in the upper right corner of the display at the end of every print line to indicate proper operation. At any time you can abort the despool process by holding down the left and right arrow keys simultaneously. The despooler will disconnect itself from the operating system and display an "abort" message. If the despooler runs to completion, a "print complete" message will appear on the display.

#### **Despooling Theory**

Study Program Listing 2. When executed, this program also begins execution at the label Start on the listing. The despooler first protects itself from Basic and DOS by modifying the DOS top of memory pointer at 4049H. This memory pointer is saved so the full memory area can be restored when the despool process is complete. The program then requests a filespec from the operator. A default is available. When a valid filespec is input, the file is opened and the first record is read into the disk I/O buffer located at FF00H. The first byte of the first buffer contains the number-of-copies byte which is then transferred into memory for later use. By setting the NRN (next record number) to 0000H, the next read will again read the first record of the file. The despooler then patches itself into the operating system interrupt task table and the keyboard scan routine. The address of the normal keyboard driver is saved for restoration later. It is used to modify the despool code so that calls can be made to it.

The interrupt task table in the operating system (located in SYSO/SYS at addresses 4500-4517H) is a list of routine addresses that are executed at interrupt time. Normally, this list is filled with the default address of 45A3H which tells the DOS interrupt handler not to do anything at the interrupt time. When you execute the DOS Debug, Trace or Clock functions, the operating system then places the addresses of these routines into the task list so they are executed each interrupt time. I placed a pointer to my own interrupt task (HANDLR) into the task table (at an ordinarily empty location) so it gets executed each interrupt time also. By doing this, no other interrupt tasks are disturbed so Debug, Clock and Trace can run along with the despooler if desired.

HANDLR checks the line-printer status to see if it is ready for another character and checks if another character is ready to be output to the printer. It also performs numerous housekeep-

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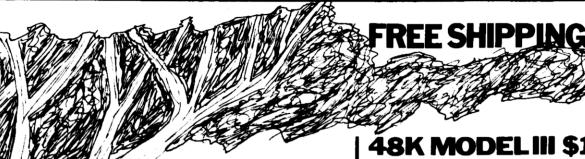
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Listing 1 continued					
8159 El	82498			HL	
815A C9	02500 02510	;	RET		
	02520	SINGLE	LINE MES	SSAGE OUTPUT RO	UTINE
815B 7E	02530 02540		LD	A,(BL)	GET CHAR
815C B7 815D C8	02550 02560		OR RET	A Z	IS IT 6 ?
815E FE03	02570		CP	3	OTHER TERMINATOR
8160 C8 8161 CD3300	02580 02590		RET CALL	Z CHROUT	; IF YES THEN ; DISPLAY IT
8164 23	02600		INC	HL	NEXT CHAR
8165 18P4	02610 02620		JR	LOUT	UNTIL FINISHED
		; MULTIP	LE LINE N	MESSAGE OUTPUT	ROUTINE
8167 D5	02650	, MSGOUT	PUSH	DE	; SAVE REGISTERS
8168 C5 8169 3EØF	Ø266Ø Ø267Ø		PUSH LD	BC A,15	CURSOR OFF CODE
816B CD3300	02680	MGCG.	CALL	CHROUT	OUTPUT IT
816E 112040 8171 010200	02690 02700	MSGØ1	LD LD	DE, CURSOR BC, 2	CURR CURSOR STORAGE MOVE ADDRESS
8174 EDBØ 8176 CD5B81	02710 02720		LDIR CALL	LOUT	; INTO CURSOR STORAGE ; DISPLAY MSG LINE
	02730				, "A" REG HAS TERM. CHAR
8179 23 817A B7	02740 02750		INC OR	HL A	PT AT NEXT SCREEN ADDR.
817B 20F1	02760		JR	NZ,MSGØ1	; LOOP UNTIL FINISHED
817D 3E0E 817F CD3300	02770 02780		LD CALL	A,14 CHROUT	; CURSOR ON CHAR ; DO IT
8182 Cl	02790		POP	BC DE	RESTORE REGISTERS
8183 D1 8184 C9	02800 02810		POP RET		
	02820 02830	;	****		
	02840	;START	OF THE M	AIN PROGRAM	
	Ø286Ø	;*****			
8185 CDC901 8188 AF	02870 02880	START	CALL XOR	CLRSCN A	;CLEAR DISPLAY ;CLEAR "A"
8189 321543	02890		LD	A (4315H),A	DEBUG OFF
818C 21FD7F 818F CD6781	02900 02910		LD CALL	HL,MSG1 MSGOUT	;SIGN ON MSG ;DISPLAY IT
	02920	;			•
8192 11A97A 8195 CD3044	02930 02940		LD CALL	DE,DCB LOAD	;PT AT SCRIPSIT DCB ;LOAD FILE
8198 280C	02950		JR	Z, CONT	; IF NOT AVALIABLE THEN
819A CDC901 819D 213081	02960 02970		CALL LD	CLRSCN HL,EMSG1	; CLEAR DISPLAY ; NOT FOUND MSG
81AØ CD5B81 81A3 C32D4Ø	02980 02990		CALL JP	LOUT	DISPLAY IT
	03000	7			. Ot con perc
81A6 CD2844	03010 03020		CALL	CLOSE	CLOSE FILE
		;OVERLA	Y SCRIPS	IT SIGN ON MSG	WITH A NEW ONE
81A9 21FD80	03050		LD	HL,MSG7	PT AT NEW SIGN ON MSG
81AC 11F757 81AF 013300	03060 03070		LD	DE,57F7H BC,51	
81B2 EDBØ	93989		LDIR	-	MOVE INTO PLACE
	03090 03100	,*****	****		
	03110	; PATCH	SCRIPSIT	•	
	03130	;		N OP MYMDIS	MAKE ROOM FOR SPOOLER
01	03150	;			
81B4 21FD7F 81B7 227752	03160 03170		LD LD	HL,MSG1 (5277H),HL	START OF NEW TXTBUF
81BA 221654 81BD 223255	03180 03190	l	LD LD	(5416H),HL	
81CØ 229359	03200	1	LD	(5532H),HL (5993H),HL	
81C3 22CB59 81C6 22B65D	03210 03220		LD LD	(59CBH),HL (5DB6H),HL	
81C9 221663	03230	l	LD	(6316H),HL	
81CC 225263 81CF 22DF66	03240 03250	ı	LD LD	(6352H),HL (66DFH),HL	
81D2 22B469	03260	1	LD	(69B4H),HL	
81D5 22256E 81D8 221A74	03270 03280	1	LD LD	(6E25H),HL (741AH),HL	
81DB 222874	03290 03300		LD	(7428H),HL	
	03310	; INSERT	LONG JU	IMP CODE FOR PAT	TCH INSERTION INTO SCRIPSIT
81DE 3EC3	03320 03330	)	LD	A, 0C3H	;LONG JMP CODE
81EØ 32E85F 81E3 329E7A	03340 03350		LD LD	(5FE8H),A (7A9EH),A	; PATCH KEYBOARD ROUTINE ; UNDERLINE ROUTINE
81E6 32AF5F	Ø336Ø Ø337Ø	)	LD	(SPAPH),A	VIDEO UNDERSCORE
	03380	;STORE	PATCH RO	OUTINE ADDRESSES	S IN SCRIPSIT
81E9 21857F	03390 03400	) ;	LD	HL, KEYMOD	
81EC 22E95F	03410	)	LD	(SPE9H), HL	
81EF 21CE7F 81F2 229F7A	03420 03430	)	I.D	HL,UNDRLN (7A9FH),HL	
81F5 21EF7F 81F8 22BØ5F	03440 03450	J	LD	HL, VUNDRL (5FBØH), HL	
	03460	;		, 3, 300//85	.CIOID 5-2
817B AF 81FC 32C052	03470 03480	,	XOR LD	A (52СØH), <b>A</b>	CLEAR "A" NOP DI INSTRUCTION
	03490	1;		I/O TO SPOOLER	
	03510		- MINTER	., o to spooleR	
					Listing 1 continues
<u> </u>					



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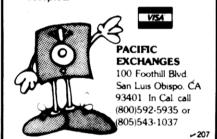
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Listing I continu	ued				
81FF 21D47B	03520		LD	HL, IN	PT AT STATUS IN INST.
8202 11635F 8205 CD5381	03530 03540		LD CALL	DE,5F63H INSMV	;PATCH POINT #1
8208 113F66 820B CD5381	03550 03560		LD CALL	DE,663FH INSMV	; PATCH POINT #2
820E 115066	03570		LD	DE,6650H	; PATCH POINT #3
8211 CD5381 8214 21DA7B	Ø358Ø Ø359Ø		CALL LD	INSMV HL,OUT	PT AT PRT OUT INST.
8217 114452 821A CD5381	03600 03610		LD CALL	DE,5244H INSMV	; PATCH POINT #4
821D 115E66	03620		LD	DE,665EH	;PATCH POINT \$5
8220 CD5381 8223 112267	03630 03640		CALL LD	INSMV DE,6722H	; PATCH POINT #6
8226 CD5381 8229 11977A	03650 03660		CALL LD	INSMV DE,7A97H	:PATCH POINT #7
822C CD5381	03670		CALL	INSMV	FRICE POINT #/
	03690	PATCH S	CRIPSIT	MEMORY SIZE ROUT	INE
822F 21D77B	03700 03710	;	LD	HL,MEM	PT AT MEM LIMIT INST.
8232 116052 8235 CD5381	03720 03730		LD	DE,5260H	; PATCH POINT #8
0233 (23381	03740		CALL	INSMV	
	03750 03760		SCRIPSIT	END ROUTINE	
8238 21627F 823B 229565	03770 03780	•	LD	HL,CSPOOL	CLOSE SPOOL FILE STORE IN "END" ROUTINE
0235 229303	83798	,	LD	(6595H),HL	1810RE IN END ROUTINE
		ON WITH	THE SHO	OW .	
	03820 03830	,*****	****		
823E CDC901	93849	INPARM	CALL	CLRSCN	CLEAR SCREEN
8241 211180 8244 CD5B81	03850 03860		LD CALL	HL,MSG2+2 LOUT	; PROGRAM NAME
8247 219080 824A CD5B81	03870 03880		LD CALL	HL,MSG3 LOUT	;DRIVE * MSG
824D CD4900	03890		CALL	KEYIN	GET RESPONSE
8250 FEØD 8252 280E	03900 03910		CP JR	13 2,IN1	;DEFAULT ? ;IF YES THEN
8254 FE3Ø 8256 38E6	03920 03930		CP JR	C, INPARM	CHECK RANGE
8258 FE34	03940		CP	141	
825A 30E2 825C CD3300	03950 03960		JR CALL	NC, INPARM CHROUT	; IF IN RANGE CONTINUE ; DISPLAY SELECTION
825F 32D17B 8262 21C87B	03970 03980	TNI	LD LD	(FNAME+9),A	STORE IN FILENAME
8265 11A97A	03990	1111	LD	HL, PNAME DE, DCB	;PT AT FILENAME ;DCB STORAGE
8268 CD1C44 826B 21C97A	04000 04010		CALL LD	PARSE HL,DISKIO	; MOVE INTO PLACE ; DISK I/O BUFFER
826E 0600 8270 CD2044	04020 04030		LD CALL	B,Ø Init	;LRL=256 ;INITIALIZE FILE
8273 C28182	04040		JP	NZ, ERROR	; IF PROBLEM THEN
8276 381E 8278 CD2844	04050 04060		JR CALL	C, NEW CLOSE	; IF NEW FILE THEN ; ELSE CLOSE OLD FILE
827B 21CB7B 827E 34	04070 04080		LD INC	HL,FNAME+3 (HL)	PT AT FILE VER #
827F 18E1	04090		JR	INI	TRY AGAIN FOR NEW FILE
	04100 04110		DISK I/O	ERROR	
8281 F5	04120 04130	; ERROR	PUSH	AF	;SAVE ERROR CODE
8282 3E0D 8284 CD3300	84148		LD	A,13	CR TO DISPLAY
8287 F1	04150 04160		CALL POP	CHROUT AF	; RESTORE ERROR CODE
8288 F6C0 828A CD0944	04170 04180		OR CALL	0C0H ERROUT	; SHORT ERROR MSG
828D 11A97A 829Ø CD2844	04190	DONE	LD	DE,DCB	PT AT DISK DCB
8293 C32D4Ø	04200 04210		CALL JP	CLOSE OPSYS	; CLOSE FILE ; BACK TO OS
	04220 04230		ERE WHEN	NEW FILE IS CREA	ATED
8296 21B580	04240 04250	;	LD		
8299 CD5B81	84268		CYLL	HL,MSG4 LOUT	;FILE CREATE MSG
829C 21C87B 829F CD5B81	04270 04280		LD CALL	HL, FNAME LOUT	;PT AT FILE NAME ;DISPLAY IT
82A2 21C680 82A5 CD5B81	04290 04300	NEW1	LD CALL	HL,MSG5 LOUT	;PT AT # OF COPYS MSG
82A8 CD4900 82AB CD3300	04310 04320		CALL	KEYIN CHROUT	;INPUT 0-9 ;DISPLAY ANSWER
82AE FEØD	04330		CP	13	;DEFAULT ?
82BØ 28ØA 82B2 D63Ø	04340 04350		JR SUB	Z,NEW2 30H	; IF YES THEN ; CHK LOWER BOUND
82B4 38EC 82B6 FEØA	04360 04370		JR CP	C,NEW1 ØAH	; IF < 30H THEN ASK AGAIN ; CHK UPPER BOUND
82B8 3ØE8	04380		JR	NC, NEW1	; IF > 39H THEN ASK AGAIN
82BA 1802 82BC 3E01	04390 04400		JR LD	NEW3 A,1	;DEFALUT = 1 COPY
82BE 32C97A	04410 04420	NEW3	LD	(DISKIO),A	;STORE # IN ;DISK I/O BUF
82C1 21E180 82C4 CD5B81	84438 84448		LD CALL	HL,MSG6 LOUT	CORRECT MSG
82C7 CD4900	04450		CALL	KEYIN	GET RESPONSE
82CA CBAF 82CC FE4E	04460 04470		RES CP	5,A 'N'	; CONV TO UC ; ANSWER NO ?
82CE C23F52	04480 04490		JP	NZ, WP	; IF NOT EXECUTE SCRIPSIT
82D1 11A97A	04500	•	LD	DE,DCB	; IF INCORRECT KILL FILE
82D4 CD2C44 82D7 C33E82	04510 04520		CALL JP	KILL Inparm	GO ASK AGAIN
	04530 04540				
8185 00000 TOTAL	04550	•	END	START	
DUDU TOTAL					

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ing tasks including incrementing and decrementing pointers and counters. It also polls a flag (Flag) to determine if the byte to be output is the number-ofcopies byte and if so, skips it.

The other interface for the despooler is the keyboard driver. Every time the keyboard is scanned for an input character, all other despooler housekeeping tasks are performed. During these times the spool file is read into the disk I/O buffer if more characters are needed for the printer. The abort function is also checked during each of the keyboard scan times.

#### Getting the Programs to Work

Type the source code provided into an editor/assembler. This makes it easy to relocate the despool program for your correct memory size. The despooler should reside at the top of your memory, with the ORGs for the various memory sizes shown in Listing 2. The spooler program must be assembled at the origin location shown in Listing 1 regardless of memory size. I used the filenames SSPOOL/CMD for the spooler program and DESPOOL/CMD for the despooler program. I called it SSPOOL, for Scripsit Spooler, to distinguish it from NSPOOL,



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which is a spooler I have also written to use with Basic and all other print sources that use the printer device control block for channeling of printer I/O. I will present this program in a fu-

ture article. The despooler presented in this article works with both spoolers.

Craig Lindley can be reached at P.O. Box 704, Colorado Springs, CO 80901.

			Program Listing 2. Despooler						
		00100	188						
		00110			SPOOLER UTILITY	***			
		60126	, ***		SPOOLER V1.8	***			
		00130	, * * *	NOV	EMBER 11, 1981	***			
		00140			BY	***			
			;*** CRAIG A. LINDLEY ***						
		00160 00170	;						
		66186	,	****					
			SYSTEM						
		88288	, *****	***					
		00210	,						
3840			ARROWS	EQU	3840H	CURSOR ARROWS KEY ADDR			
022C			BLINK	EQU	Ø22CH	;BLINK "*" ROUTINE			
0033			CHROUT		.0033H	CHAR OUT ROUTINE			
4020 0060			CURSOR DELAY	EQU	4020H	CURSOR STORAGE			
4510			INT25	EQU EQU	0060H 4510H	; ROM DELAY ROUTINE ; INTERRUPT TABLE ADDR			
4016			KEYDCB	EQU	4016H	KEYBOARD DCB			
35D9			LINEIN	EQU	Ø5D9H	; ROM LINE INPUT ROUTINE			
44CF		00300		EQU	44CPH	DOS LINE OUT ROUTINE			
424		00310		EQU	4424H	OPEN DISK FILE			
8 2D			OPSYS	EQU	402DH	REENTER DOS			
41C			PARSE	EQU	441CH	PARSE FILESPEC ROUTINE			
436		00340		EQU	4436H	READ DISK FILE			
049			TOPMEM	EQU	4049H	DOS TOP OF MEM PTR			
D28		00360 00370	;	OPC	aph 2 au				
J 2 8		00370 00380		ORG	ØFD2ØH				
			;*****	****					
					LOCATIONS				
		00410	,*****	****	20 CH 1 2 CM 2				
		99429	;						
020		00430		DEFS	32	FILESPEC STORAGE			
D28		00440		EQU	DCB+8	; EOF STORAGE IN DCB			
D2C		00450		EQU	DCB+12	END REC. NUMBER IN DCB			
D2A	4422	99469		EQU	DCB+10	; NEXT REC. NUMBER IN DCB			
	ØØFF		BUFPTR	DEFW	DISKIO	POINTER TO DATA BUFFER			
001	0000	00480 00490	CHRCNT COPYS	DEFW DEFS	Ø 1	BUFFER CHAR COUNT			
0001			EOFCNT	DEPS	i	; # OF COPIES STORAGE ; EOF SECTOR BYTE COUNT			
D46	88	00510		DEFB	Ø	;1ST CHAR OF FILE FLAG			
		00520			-	, come of time time			
D47	50		FNAME	DEFM	'PRT1/DAT'	;DEFAULT FILESPEC			
D4F		00540		DEFB	13				
D50	00	00550		DEFB	Ø				
		00560			_				
9002 9002			KEYDVR	DEFS	2	KEYBOARD DVR STORAGE			
3002			MEMSI2 SAVTSK	DEFS DEFS	2 2	TRUE MEM SIZE STORAGE INTERRUPT TASK STORAGE			
D57	aaaa				ē	CURRENT SECTOR RECORD			
			RECNUM	DEFW					
	0000		RECNUM ;	DEFW	•	CORRENT SECTOR RECORD			
		99699				TOURNENT SECTOR RECORD			
		99699 99619 99629 99639	; ; ***** ; SYSTEM	**** MESSAGES		FURNENT SECTOR RECORD			
		00600 00610 00620 00630 00640	SYSTEM	**** MESSAGES		CORREST SECTOR RECORD			
7D 5 0		99699 99619 99629 99639 99649	; ******; SYSTEM	**** Messages	3	FORABRI SECTOR RECORD			
	46	99699 99619 99629 99639 99649 99659	; ******; SYSTEM	MESSAGES	FILE:	FORABRI SECTOR RECORD			
	46	99699 99619 99629 99639 99649 99659 99669	; ***** ; SYSTEM ; ***** ; MSG1	**** Messages	3	FOUNDATI SECTOR RECORD			
D5F	46 83	99699 99619 99629 99639 99649 99659	; ******; ; SYSTEM ; ******; MSG1	MESSAGES	'FILE: '				
7D5F 7D68	46 03 46	00610 00620 00630 00640 00660 00660 00660 00690	; ***** ; SYSTEM ; ***** ; MSG1 ; MSG2	MESSAGES	FILE:				
FD59 PD5F PD68	46 Ø3 46 ØD	99699 99619 99629 99639 99659 99669 99699 99719	; ******; SYSTEM; ******; MSG1	MESSAGES  DEPM DEFB DEFM DEFB	'FILE: '3 'FILE NOT FOUND				
7D5F 7D68 7D78	46 83 46 8D	08610 08610 08630 08630 08650 08650 08660 08670 08670 08710 08710	; ******; SYSTEM; ******; MSG1	MESSAGES ****  DEFM DEFB  DEFM DEFB	'FILE: ' 3 'FILE NOT FOUND 13 'FILE COPIES: '				
7D5F 7D68 7D78	46 83 46 8D	98610 98610 98630 98630 98650 98650 98650 98670 98710 987710	; ******; ; SYSTEM; ; ******; ; MSG1 ; MSG2 ; MSG3	MESSAGES  DEPM DEFB DEFM DEFB	'FILE: '3 'FILE NOT FOUND				
D5F D68 D76 D71 D71	46 83 46 8D 46 83	88618 88618 88638 88638 88658 88658 88678 88788 88748 88748	; ******; ;SYSTEM; ;******; MSG1 ; MSG2 ; MSG3	MESSAGES ****  DEFM DEFB  DEFM DEFB  DEFB	'FILE: '3 'FILE NOT FOUND 13 'FILE COPIES: '3				
7D5F 7D68 7D76 7D71 7D7E 7D7F	46 83 46 8D 46 83	88618 88618 88638 88658 88658 88658 88658 88658 88678 88718 88718 88758	; ******; ;SYSTEM; ;******; MSG1 ; MSG2 ; MSG3	MESSAGES  MESSAGES  DEFM DEFB DEFM DEFB DEFM DEFB DEFM DEFB	'FILE: ' 3 'FILE NOT FOUND 13 'FILE COPIES: ' 3 'ABORTED'				
PD5F PD68 PD76 PD76 PD71 PD7E	46 83 46 8D 46 83	986 98 986 19 986 39 986 39 986 59 986 59 986 79 987 39 987 39 987 39 987 59 987 59	; ******; ; SYSTEM; ******; MSG1 ; MSG2 ; MSG3	MESSAGES ****  DEFM DEFB  DEFM DEFB  DEFB	'FILE: '3 'FILE NOT FOUND 13 'FILE COPIES: '3				
7D5F 7D68 7D78 7D71 7D7E 7D7F 7D7F 7D86	46 83 46 8D 46 83 41 8D	88618 88618 88638 88658 88658 88658 88658 88658 88678 88718 88718 88758	; ******; ; SYSTEM; ; ******; MSG1 ; MSG2 ; MSG3 ; MSG4	MESSAGES  MESSAGES  DEFM DEFB DEFM DEFB DEFM DEFB DEFM DEFB	'FILE: ' 3 'FILE NOT FOUND 13 'FILE COPIES: ' 3 'ABORTED' 13	11			
7D5F 7D68 7D70 7D71 7D7E 7D7F 7D86	46 03 46 0D 46 03 41 0D	88688 88618 88638 88638 886648 88668 88678 88738 88738 88738 88778 88778 88788	;;******; ;SYSTEM;;******; ;MSG1 ;MSG2 ;MSG3 ;MSG4 ;MSG5	MESSAGES  DEPM DEFB  DEPM DEFB  DEFM DEFB  DEFM DEFB  DEFM DEFB	'FILE: ' 3 'FILE NOT FOUND 13 'FILE COPIES: ' 3 'ABORTED'	11			
7D5F 7D68 7D70 7D71 7D7E 7D7F 7D86	46 03 46 0D 46 03 41 0D	8668 8863 8863 8863 8863 8863 8863 8863	;;******; ;SYSTEM;****** ;MSG1 ;MSG2 ;MSG3 ;MSG3 ;MSG4 ;MSG5 ;	DEFM DEFB	'FILE: ' 3 'FILE NOT FOUND 13 'FILE COPIES: ' 3 'ABORTED' 13 'PRINT COMPLETE	11			
7D5F 7D68 7D70 7D71 7D7E 7D7F 7D86	46 03 46 0D 46 03 41 0D	88618 88618 88628 88634 88658 88658 88658 88778 88778 88778 88778 88778 88778 88778 88778 88788 88788	;;******; ;SYSTEM;****** ;MSG1 ;MSG2 ;MSG3 ;MSG4 ;MSG5	MESSAGES  ****  DEFM DEFB  DEFM DEFB  DEFM DEFB  DEFM DEFB  DEFM DEFB  DEFM DEFB	'FILE: ' 3 'FILE NOT FOUND 13 'FILE COPIES: ' 3 'ABORTED' 13 'PRINT COMPLETE' 13	11			
7D5F 7D68 7D70 7D71 7D7E 7D7F 7D86	46 03 46 0D 46 03 41 0D	88618 88618 88628 88638 88658 88658 88658 886718 88718 88778 88778 88778 88778 88788 8788 87888 8788 87888 87888 87888 87888 87888 87888 87888 87888 87888 87888 8	;;***** ;SYSTEM ;***** ;MSG1 ;MSG2 ;MSG3 ;MSG3 ;MSG4 ; ;START ;START	DEFM DEFB	'FILE: ' 3 'FILE NOT FOUND 13 'FILE COPIES: ' 3 'ABORTED' 13 'PRINT COMPLETE	11			
7D5F 7D68 7D70 7D71 7D7E 7D7F 7D86	46 03 46 0D 46 03 41 0D	88618 88638 88638 88638 886638 88668 88668 88678 88778 88773 88773 88773 88773 88778 88778 88778 88778 88778 88778 88788 88788	;;******; ;SYSTEM;****** ;MSG1 ;MSG2 ;MSG3 ;MSG4 ;MSG5 ;****** ;START (;******	DEFM DEFB	'FILE: ' 3 'FILE NOT FOUND 13 'FILE COPIES: ' 3 'ABORTED' 13 'PRINT COMPLETE' 13	11			
7D5F 7D68 7D78 7D71 7D7E 7D7F 7D86 7D87 7D87	46 03 46 0D 46 03 41 0D	88618 88618 88618 88628 88658 88658 88658 88718 887718 887718 887718 887718 887718 887718 887718 887718 887718 887718 887718 887718 887718 887718 887718 887718	; ; ****** ; SYSTEM; ***** ; MSG1 ; MSG2 ; MSG3 ; MSG5 ; START (; ******	DEFM DEFB	'FILE: ' 3 'FILE NOT FOUND 13 'FILE COPIES: ' 3 'ABORTED' 13 'PRINT COMPLETE 13 AIN PROGRAM	1'			
7D5F 7D68 7D70 7D71 7D7E 7D7F 7D86 7D85 7D95	46 83 46 8D 46 83 41 8D 58 8D	88618 88618 88618 88628 88658 88658 88658 88718 887718 887718 887718 887718 887718 887718 887718 887718 887718 887718 887718 887718 887718 887718 887718 887718	;;******; ;SYSTEM;****** ;MSG1 ;MSG2 ;MSG3 ;MSG4 ;MSG5 ;****** ;START (;******	DEFM DEFB	'FILE: ' 3 'FILE NOT FOUND 13 'FILE COPIES: ' 3 'ABORTED' 13 'PRINT COMPLETE' 13	;GET TRUE TOP OF MEM			
7D5F 7D68 7D70 7D7E 7D7F 7D86 7D95 7D95	46 03 46 0D 46 03 41 0D 50 0D	88618 88618 88628 88638 88658 88658 88658 886718 887718 887718 887718 887718 887718 887718 88788 8788 87888 8788 87888 87888 87888 87888 87888 87888 87888 87888 87888 87888 8	; ; ****** ; SYSTEM; ***** ; MSG1 ; MSG2 ; MSG3 ; MSG5 ; START (; ******	DEFM DEFB DEFM DEFM DEFB DEFM DEFM DEFM DEFM DEFM DEFM DEFM DEFM	'FILE: '3 'FILE NOT FOUND 13 'FILE COPIES: '3 'ABORTED' 13 'PRINT COMPLETE 13 AIN PROGRAM HL, (TOPMEM)	1'			
7D5F 7D68 7D70 7D71 7D7E 7D7F 7D86 7D85 7D95	46 83 46 8D 46 83 41 8D 58 8D	88618 88618 88628 88634 88658 88658 88658 886718 887718 887718 887718 887718 887718 887718 887718 887718 88788 8788 87888 8788	;;****** ;SYSTEM ;***** ;MSG1 ;MSG2 ;MSG3 ;MSG4 ;MSG5 ;***** ;START	DEFM DEFB DEFM DEFM DEFB DEFM DEFM DEFM DEFM DEFM DEFM DEFM DEFM	'FILE: ' 3 'FILE NOT FOUND 13 'FILE COPIES: ' 3 'ABORTED' 13 'PRINT COMPLETE' 13 AIN PROGRAM HL, (TOPMEM) (MEMSIZ), HL	;GET TRUE TOP OF MEM;STORE FOR LATER			
PD5F PD68 PD76 PD77 PD7F PD86 PD87 PD95	46 83 46 8D 46 83 41 8D 58 8D 2A4948 2253FD 2116FD 224948	88618 88618 88628 88634 88654 88656 88658 88778 88773 88773 88773 88773 88776 88776 88778 88776 88778 88776 88778 88778 88776 88778 887888 88788 8788 87888	;;******; ;SYSTEM;******; ;MSG1 ;MSG2 ;MSG3 ;MSG4 ;MSG5 ;****** ;START ;******; ;START	DEFM DEFB DEFM DEFM DEFM DEFM DEFM DEFM DEFM DEFM	'FILE: ' 3 'FILE NOT FOUND 13 'FILE COPIES: ' 3 'ABORTED' 13 'PRINT COMPLETE' 13 AIN PROGRAM HL, (TOPMEM) (MEMSIZ), HL HL, DCB-18 (TOPMEM), HL	;GET TRUE TOP OF MEM ;STORE FOR LATER ;MEMORY PROTECT LIMIT ;DOS TOP OF MEM PTR			
PD5F PD68 PD70 PD71 PD7E PD86 PD86 PD95 PD96 PD99 PD9C PD97 PDA2	46 83 46 8D 46 83 41 8D 58 8D 224948 2253FD 2116FD 224948	88618 88618 88618 88648 88648 88658 88658 88718 887718 887718 887718 887718 887718 887718 887718 88778 88778 88778 88778 88778 88778 88778 88788 8788 87888	;;******; ;SYSTEM;******; ;MSG1 ;MSG2 ;MSG3 ;MSG4 ;MSG5 ;****** ;START ;******; ;START	DEFM DEFB DEFM DEFM DEFB DEFM DEFM DEFM DEFM DEFM DEFM DEFM DEFM	'FILE: ' 3 'FILE NOT FOUND 13 'FILE COPIES: ' 3 'ABORTED' 13 'PRINT COMPLETE 13 AIN PROGRAM HL, (TOPMEM) (MEMSIZ), HL HL, DCB-18 (TOPMEM), HL	;GET TRUE TOP OF MEM ;STORE FOR LATER ;MEMORY PROTECT LIMIT ;DOS TOP OF MEM PTR ;PT AT INPUT BUPPER			
PD5F PD68 PD78 PD77 PD76 PD77 PD86 PD87 PD95 PD99 PD96 PD99 PD96 PD97 PD82 PD83	46 83 46 8D 46 83 41 8D 58 8D 2A4948 2253FD 2116FD 224948 2128FD E5	88618 88618 88628 88634 88658 88658 88658 886718 887718 887718 887778 887778 887778 88778 88778 88778 887888 88788 8788 8788 87888 87888 87888 87888 87888 87888 87888 87888 87888 87888 8	;;******; ;SYSTEM;******; ;MSG1 ;MSG2 ;MSG3 ;MSG4 ;MSG5 ;****** ;START ;******; ;START	DEFM DEFB DEFM DEFM DEFM DEFM DEFM DEFM DEFM DEFM	'FILE: '3 'FILE NOT FOUND 13 'FILE COPIES: '3 'ABORTED' 13 'PRINT COMPLETE' 13 AIN PROGRAM HL, (TOPMEM) (MEMSIZ), HL HL, DCB-18 (TOPMEM), HL HL, DCB	;GET TRUE TOP OF MEM ;STORE FOR LATER ;MEMORY PROTECT LIMIT ;DOS TOP OF MEM PTR ;PT AT INPUT BUPPER ;SAVE ADDRESS			
PD5F PD68 PD78 PD78 PD71 PD7F PD86 PD95 PD96 PD99 PD96 PD99 PD96 PD96 PD96 PD96	46 83 46 8D 46 83 41 8D 58 8D 2A4948 2253FD 2116FD 224948 2128FD E5	886188868188862888888888888888888888888	;;******; ;SYSTEM;******; ;MSG1 ;MSG2 ;MSG3 ;MSG4 ;MSG5 ;****** ;START ;******; ;START	DEFM DEFB DEFM DEFM DEFM DEFM DEFM DEFM DEFM DEFM	'FILE: ' 3 'FILE NOT FOUND 13 'FILE COPIES: ' 3 'ABORTED' 13 'PRINT COMPLETE' 13 AIN PROGRAM HL, (TOPMEM) (MEMSI2), HL HL, DCB-18 (TOPMEM), HL HL, DCB HL B, 32	;GET TRUE TOP OF MEM ;STORE FOR LATER ;MEMORY PROTECT LIMIT ;DOS TOP OF MEM PTR ;PT AT INPUT BUFFER ;SAVE ADDRESS ;STORE 32			
PD5F PD68 PD70 PD71 PD7E PD76 PD86 PD87 PD95 PD96 PD99 PD9C PD96 PD82 PD9A6 PDA88	46 83 46 8D 46 83 41 8D 58 8D 224948 2253FD 2116FD 224948 2128FD E5 8628	88618 88618 88618 88638 88638 88658 88658 886718 88718 88778 88778 88778 88778 88778 88778 88788 88778 88788 89788	; ; ****** ; SYSTEM ; ****** ; MSG1 ; MSG2 ; MSG3 ; MSG4 ; MSG5 ; ***** ; START ; ****** ; ASK	DEFM DEFB DEFM DEFM DEFB DEFM DEFB DEFM DEFM DEFB DEFM DEFM DEFM DEFM DEFM DEFM DEFM DEFM	'FILE: '3 'FILE NOT FOUND 13 'FILE COPIES: '3 'ABORTED' 13 'PRINT COMPLETE 13 AIN PROGRAM HL, (TOPMEM) (MEMSI2), HL HL, DCB HL HL, DCB HL B, 32 A, 28H	;GET TRUE TOP OF MEM ;STORE FOR LATER ;MEMORY PROTECT LIMIT ;DOS TOP OF MEM PTR ;PT AT INPUT BUFFER ;SAVE ADDRESS ;STORE 32 ;SPACE CODES FOR DCB			
PD5F PD68 PD78 PD71 PD7F PD86 PD79 PD95 PD96 PD95 PD96 PD96 PD97 PD96 PD96 PD96 PD97 PDA2 PDA5 PDA6 PDAA6 PDAA6	46 83 46 8D 46 8D 41 8D 58 8D 2A4948 2253FD 2116FD 24948 2128FD E5 8628 3E28 77	88618888608886089388693886988869888698886988	; ; ****** ; SYSTEM ; ****** ; MSG1 ; MSG2 ; MSG3 ; MSG4 ; MSG5 ; ***** ; START ; ****** ; ASK	DEFM DEFB DEFM DEFM DEFB DEFM DEFM DEFM DEFM DEFM DEFM DEFM DEFM	'FILE: '3 'FILE NOT FOUND 13 'FILE COPIES: '3 'ABORTED' 13 'PRINT COMPLETE' 13 AIN PROGRAM HL, (TOPMEM) (MEMSIZ), HL HL,DCB-18 (TOPMEM), HL HL,DCB HL B,32 A,29H (HL),A	;GET TRUE TOP OF MEM ;STORE FOR LATER ;MEMORY PROTECT LIMIT ;DOS TOP OF MEM PTR ;PT AT INPUT BUFFER ;SAVE ADDRESS ;STORE 32			
PD5F PD68 PD78 PD71 PD7E PD7F PD86 PD87 PD95 PD96 PD99 PD97 PDA2 PDA2 PDA3 PDA8 PDA8	46 83 46 8D 46 8D 41 8D 58 8D 2A4948 2253FD 2116FD 24948 2128FD E5 8628 3E28 77	88618 88618 88618 88638 88638 88658 88658 886718 88718 88778 88778 88778 88778 88778 88778 88788 88778 88788 89788	; ; ****** ; SYSTEM ; ****** ; MSG1 ; MSG2 ; MSG3 ; MSG4 ; MSG5 ; ***** ; START ; ****** ; ASK	DEFM DEFB DEFM DEFM DEFM DEFM DEFM DEFM DEFM DEFM	'FILE: '3 'FILE NOT FOUND 13 'FILE COPIES: '3 'ABORTED' 13 'PRINT COMPLETE' 13 AIN PROGRAM HL, (TOPMEM) (MEMSI2), HL HL, DCB-18 (TOPMEM), HL HL, DCB HL B, 32 A, 28H (HL), A HL	;GET TRUE TOP OF MEM ;STORE FOR LATER ;MEMORY PROTECT LIMIT ;DOS TOP OF MEM PTR ;PT AT INPUT BUFFER ;SAVE ADDRESS ;STORE 32 ;SPACE CODES FOR DCB ;STORE SPACE			
PD5F PD68 PD78 PD71 PD7E PD7F PD86 PD87 PD95 PD96 PD99 PD97 PDA2 PDA2 PDA3 PDA8 PDA8	46 03 46 0D 46 03 41 0D 50 0D 2A4940 2253FD 2116FD 224940 2120FD E5 9620 3E20 77 23	886188868188866188866188866188866188866188866188866188866188866188866188866188866188866188666188666188666188666188666188666188666188666188666188666188666188666188666188666188666188666188666618866661886666188666666	;;****** ;SYSTEM ;***** ;MSG1 ;MSG2 ;MSG3 ;MSG4 ;MSG5 ;***** ;START ;START ;ASK	DEFM DEFB DEFM DEFM DEFB DEFM DEFM DEFM DEFM DEFM DEFM DEFM DEFM	'FILE: '3 'FILE NOT FOUND 13 'FILE COPIES: '3 'ABORTED' 13 'PRINT COMPLETE' 13 AIN PROGRAM HL, (TOPMEM) (MEMSIZ), HL HL,DCB-18 (TOPMEM), HL HL,DCB HL B,32 A,29H (HL),A	;GET TRUE TOP OF MEM ;STORE FOR LATER ;MEMORY PROTECT LIMIT ;DOS TOP OF MEM PTR ;PT AT INPUT BUFFER ;SAVE ADDRESS ;STORE 32 ;SPACE CODES FOR DCB			
PDSP PD68 PD78 PD71 PD7E PD86 PD86 PD95 PD95 PD95 PD95 PD95 PD95 PDA6 PDA8 PDA8 PDA8 PDA8 PDA8 PDA8 PDA8 PDA8	46 83 46 8D 46 83 41 8D 58 8D 2A4948 2253FD 2116FD 224948 2128FD E5 9628 3E28 77 23 18FC 2159FD	88618888888888888888888888888888888888	;;****** ;SYSTEM ;***** ;MSG1 ;MSG2 ;MSG3 ;MSG4 ;MSG5 ;***** ;START ;START ;ASK	DEPM DEFB DEPM DEFB DEFM DEFM DEFM DEFM DEFM DEFM DEFM DEFM	'FILE: '3 'FILE NOT FOUND 13 'FILE COPIES: '3 'ABORTED' 13 'PRINT COMPLETE' 13 AIN PROGRAM HL, (TOPMEM) (MEMSI2), HL HL, DCB-18 (TOPMEM), HL HL, DCB HL B, 32 A, 28H (HL), A HL	;GET TRUE TOP OF MEM ;STORE FOR LATER ;MEMORY PROTECT LIMIT ;DOS TOP OF MEM PTR ;PT AT INPUT BUFFER ;SAVE ADDRESS ;STORE 32 ;SPACE CODES FOR DCB ;STORE SPACE			
PDSF PD68 PD78 PD71 PD75 PD86 PD86 PD95 PD95 PD96 PD99 PD99 PD99 PD95 PDA2 PDA3 PDA3 PDA4 PDA6 PDA6 PDA6 PDA6 PDA6 PDA6 PDA6 PDA6	46 83 46 8D 46 83 41 9D 58 8D 20 224948 2253FD 2116FD 224948 2128FD E5 86 28 3E 28 77 23 18FC 2159FD CDCF44	88618888888888888888888888888888888888	;;****** ;SYSTEM ;***** ;MSG1 ;MSG2 ;MSG3 ;MSG4 ;MSG5 ;***** ;START ;START ;ASK	DEFM DEFB DEFM LD	'FILE: '3 'FILE NOT FOUND 13 'FILE COPIES: '3 'ABORTED' 13 'PRINT COMPLETE' 13 AIN PROGRAM HL, (TOPMEM) (MEMSIZ), HL HL,DCB-18 (TOPMEM), HL HL,DCB HL B,32 A,28H (HL),A HL FILL	GET TRUE TOP OF MEM STORE FOR LATER MEMORY PROTECT LIMIT DOS TOP OF MEM PTR PT AT INPUT BUFFER SAVE ADDRESS STORE 32 SPACE CODES FOR DCB STORE SPACE DO ALL 32			
PD5F PD68 PD76 PD77 PD7E PD76 PD75 PD86 PD86 PD95 PD96 PD97 PD86 PD96 PD96 PD87 PD86 PD87 PD87 PD87 PD87 PD87 PD87 PD87 PD87	46 83 46 8D 46 83 41 9D 58 8D 20 224948 2253FD 2116FD 224948 2128FD E5 86 28 3E 28 77 23 18FC 2159FD CDCF44	88618888888888888888888888888888888888	;;****** ;SYSTEM ;***** ;MSG1 ;MSG2 ;MSG3 ;MSG4 ;MSG5 ;***** ;START ;START ;ASK	DEPM DEFB DEPM DEFB DEFM DEFM DEFM DEFM DEFM DEFM DEFM DEFM	'FILE: '3 'FILE: '3 'FILE NOT FOUND 13 'FILE COPIES: '3 'ABORTED' 13 'PRINT COMPLETE' 13 AIN PROGRAM HL, (TOPMEM) (MEMSIZ), HL HL, DCB-18 (TOPMEM), HL HL, DCB HL B, 32 A, 28H (HL), A HL FILL HL, MSG1	;GET TRUE TOP OF MEM ;STORE FOR LATER ;MEMORY PROTECT LIMIT ;DOS TOP OF MEM PTR ;PT AT INPUT BUFFER ;SAVE ADDRESS ;STORE 32 ;SPACE CODES FOR DCB ;STORE SPACE ;DO ALL 32 ;SIGN ON MSG			

Listing	2 continued					
FDB5		01010		LD	B,32	;32 CHAR MAX FILESPEC
FDB7 FDBA	CDD905	01020 01030		CALL LD	LINEIN	;GET FILESPEC ;GET INPUT LENGTH
FDBB		01040		OR	A,B A	USER FILESPEC ?
PDBC	289C	01050		JR	NZ, DOPEN	; IF YES THEN
		01060 01070		FAULT PI	LESPEC	
		01080				
PDBE PDC1	1147FD EB	01090 01100		LD EX	DE, FNAME DE, HL	;PT AT DEFAULT SPEC
FDC2		81118		PUSH	HL HL	;PT AT PNAME
FDC3	CD1C44	81128		CALL	PARSE	MOVE SPEC INTO DCB
	CDCF44	01130 01140		POP CALL	HL LOUT	;DISPLAY DEFAULT
		81150				•
		01160 01170		HE SPOOL	PILE	
		01180	,*****	****		
PDCA	2100PF	91199 41244	; DOPEN	LD	HL,DISKIO	;DISK I/O BUFFER
FDCD	112 <b>6F</b> D	01210	501 DI	LD	DE, DCB	;PT AT DCB
FDD6	0600 CD2444	01220 01230		LD CALL	B, Ø Open	; LRL=0
FDD5	28 <b>8</b> F	01240		JR	Z, CONT	;OPEN SPOOL FILE ;IF ALLRIGHT THEN
	2160PD CDCF44	01250 01260		LD CALL	HI, MSG2	DISK ERROR MSG
	2A53FD	Ø127Ø		LD	LOUT HL,(MEMSIZ)	DISPLAY IT GET FULL MEMORY SIZE
	224948 C32D48	01280	200	LD	(TOPMEM),HL	STORE FOR DOS
FDES	C32D40	01290 01300	•	JP	OPSYS	; BACK TO DOS
		01310	;*****		. <del></del>	
			; ******		JPT HANDLER	
PDPf	2171FD	01340	;		UT MOC?	- CORVER NO
	CDCF44	01350 01360	CONT	LD CALL	HL,MSG3 LOUT	; COPIES MSG
FDEC	112 <b>6</b> FD	<b>01370</b>		LD	DE, DCB	POINT AT DCB
	CD3644 3AØØFF	01380 01390		CALL LD	READ A,(DISKIO)	; READ 1ST RECORD FOR ; FOR COPY COUNT
FDF5	3244FD	91488		LD	(COPYS),A	;STORE # IN MEMORY
FDF8	CD3300	01410 01420		ADD CALL	A,30H CHROUT	; CONVERT TO ASCII ; DISPLAY
		01430				; AND DISPLAY
	210000 222APD	01440 01450		LD LD	HL,0 (NRN),HL	; REWIND FILE DCB ; STORE IN DCB
		81468	;	u	(NAM) /BD	, STORE IN DCB
FE03	F3 2A1045	01470 01480		DI LD	Ut /Thim2E)	; DISABLE INTERRUPTS ; GET TABLE DATA
FE07	2255FD	01490		LD	HL,(INT25) (SAVTSK),HL	; AND SAVE
	2128FE 221045	01500 01510		LD LD	HL, PRTINT	POINTER TO PRT ROUTINE
	3A28FD	01520		rp rp	(INT25),HL A,(EOF)	; INTO INTERRUPT TABLE ; EOF BYTE COUNT FROM DCE
	3245FD 2A1640	01530		LD	(EOFCNT),A	STORE IN MEMORY
	2251FD	01540 01550		LD LD	HL, (KEYDCB) (KEYDVR), HL	GET KEY DVR ADDR
	228BFE	01560		LD	(KEY+1),HL	STORE FOR JUMP
	2163FE 221640	01570 01580		LD LD	HL, NEWDVR (KEYDCB), HL	; KEY SCAN ROUTINE ; INTO DCB
FE25		01590		EI		; INTERRUPTS ON
FE26	18BB	01600 01610		JR	DOS	; BACK TO DOS WITH ; INTERRUPT TASK ENABLED
		01620	1			, and a simple
		01630 01640	INTERR		LER ROUTINE	
			;*****	***		
FE28	2AFE	01660 01670	; PRTINT	DEPW	HANDLR	; POINTER TO INTERRUPT
		01680				; HANDLER
FE2A FE2B		01690 01700	HANDLR	PUSH PUSH	AF HL	; SAVE REGS
FE2C	DDE5	81718		PUSH	IX	
	DD2146FD 3AE837	01720 01730		LD LD	IX,FLAG A,(37E8H)	; PT AT 1ST CHAR FLAG ; READ PRT STATUS
FE35	CB7F	91749		BIT	7,A	;RDY ?
	2025 2A42FD	91759 91769		JR LD	NZ,DONE HL,(CHRCNT)	; IF NOT THEN ; GET CHAR COUNT
FE3C	7D	81778		LD	A,L	TEST FOR ZERO
FE3D FE3E		61786 61796		OR JR	H 2,DONE	; IF ZERO THEN
FE40	2B	01800		DEC	HL	DEC CHAR COUNT
	2242FD 2 <b>A4</b> 0FD	Ø181Ø		LD	(CHRCNT),HL	STORE NEW COUNT
FE47	7E	Ø1820 Ø1830		LD LD	HL,(BUFPTR) A,(HL)	GET CHAR ADDRESS
	DDCB0046 2803			BIT	0,(IX)	# OF COPYS BYTE ?
FE4E	32E837	01850 01860		JR LD	Z,SKIP (37E8H),A	; IF YES THEN ; OUTPUT TO PRINTER
	DDCB##C6	01870 01880	SKIP	SET	0,(IX)	;SET FLAG
PE57	FEØD CC2CØ2	61890		CP CALL	13 2,BLINK	;DATA = CR ? ;BLINK ***
PE5A	23 2246FD	01900 01910		INC	HL (BUFPTR),HL	BUMP PTR STORE NEW PTR
PE5E	DDE1	01920	DONE	POP	IX	RESTORE REGS
FE60 FE61		01930 01940		POP POP	HL AF	
PE62		01950		RET	nr.	
		01960 01970	;*****	****		
		01980	; LINK TO	O KEYBOAL	RD SCAN	
		01990 02000	;*****	****		
	384838	02010	NEWDVR	LD	A, (ARROWS)	; ADDRESS OF <- AND ->
	PE68 2019	82626 92838		CP JR	60H Nz,Newl	; MANUAL ABORT ? ; IF NOT THEN
. 200	,			J.	no , no #1	
						Listing 2 continue

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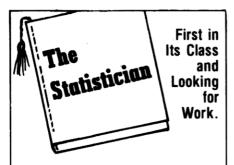
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Listing 2 continued					
	92945			ur ancen	. DOS GUDOSD ON TOST
FE6A 21C03F FE6D 222040	02040 02050		LD LD	HL,3FCØH (CURSOR),HL	; POS CUROSR ON LAST ; LINE
FE70 217FFD	02060		LD	HL, MSG4	; ABORT MSG
FE73 CDCF44	02070		CALL	LOUT	DISPLAY MSG
FE76 CDB4FE	02080		CALL	DISCON	DISCONNECT FROM OS
FE79 C5 FE7A 010000	02090 02100		PUSH LD	BC,0	; SAVE REG ; DELAY COUNT
FE7D CD6000	02110		CALL	DELAY	, Delini Cooni
FE80 Cl	02120		POP	BC `	
FE81 AF FE82 C9	Ø213Ø Ø214Ø		XOR RET	A	;"A" = Ø
1102 ()	02150	;			
	02160	;*****	***		
	02170	;JUMP HE	ERE IF NO	OT MANUAL ABORT	
	02190				
FE83 2A42FD	02200		LD	HL, (CHRCNT)	GET CHAR COUNT
FE86 7D	02210		LD	A,L	; TEST FOR ZERO
FE87 B4 FE88 2803	02220 02230		OR JR	H Z,RDISK	; IF ZERO - READ DISK
FE8A C30000	02240	KEY	JP	\$-\$	TO NORMAL KEY ROUTINE
	02250	;			
		******	SK RECO	DD.	
		,*****		KD.	
	02290	;			
FE8D 1120FD	02300	RDISK	LD	DE,DCB	PT AT DCB
FE90 CD3644 FE93 2840	02310 02320		CALL JR	READ Z,ROK	READ RECORD
	02330	;		-, mon	; IF ALLRIGHT THEN
		*****		TRID 007777	
		; CHECK I		IPLE COPIES	
	02370		-		
FE95 FE1C	02380		CP	1CH	; EOF ERROR CODE ?
FE97 2017 FE99 2144FD	02390 02400		JR LD	NZ, ABORT	; IF NOT - REAL PROBLEM
FE9C 35	02410		DEC	HL,COPYS (HL)	;PT AT # OF COPIES ;-1
FE9D 2811	02420		JR	Z,ABORT	; IF ALL DONE THEN
FE9F 210000	02430		LD	HL,0	; PREPARE TO REWIND
FEA2 222AFD FEA5 2257FD	02440 02450		LD LD	(NRN),HL (RECNUM),HL	;FILE TO BEGINNING ;CURRENT SEC RECORD = Ø
FEA8 3A28FD	02460		LD	A, (EOF)	GET EOF COUNT
FEAB 3245FD	02470		LD	(EOFCNT),A	
FEAE 18DA	02480 02490	;	JR	KEY	
	02500	*****	****		
	02510	; IF ERR	OR OR FI	NISHED - DISCONN	ECT EVERYTHING
		;*****	***		
FEBØ 218AFE	02540		LD	HL, KEY	CONT ADDR ON STACK
FEB3 E5	02550		PUSH	HL	,
FEB4 F3 FEB5 2A55FD	02560 02570	DISCON	DI LD	ut (Chumer)	DISABLE INTERRUPTS
FEB8 221045	02580		LD	HL, (SAVTSK) (INT25), HL	;GET INTERRUPT TASK ;BACK INTO OS
FEBB 2A51FD	02590		LD	HL, (KEYDVR)	NORM KEY DRIVER
FEBE 221640 FEC1 2A53FD	02600 02610		LD LD	(KEYDCB),HL HL,(MEMSIZ)	INTO DCB
FEC4 224940	02620		LD	(TOPMEM),HL	;GET TRUE MEM SIZE ;STORE FOR DOS
FEC7 21C03F	02630		LD	HL,3FCØH	POS CURSOR ON LAST
FECA 222040 FECD 2187FD	02640 02650		LD LD	(CURSOR),HL HL,MSG5	; LINE ; COMPLETE MSG
FEDØ CDCF44	02660		CALL	LOUT	DISPLAY MSG
FED3 FB	02670		EI		; INTERRUPTS ON
FED4 C9	02680 02690		RET		
	02700	,*****	***	•	
	02710	READ OF	SET UP	CHRCNT AND RETU	RN
	02720 02730	;*****			
FED5 2100FF	02740		LD	HL, DISKIO	;PT AT DISK BUFFER
FED8 2240FD	02750		LD	(BUFPTR),HL	RESET PTR TO BUFFER
FEDB 2A57FD FEDE ED5B2CFD	02760 02770		LD LD	HL, (RECNUM)	; CURRENT REC #
FEE2 DF	02780		RST	DE, (ERN) 18H	;MAX RECORD # ;ARE THEY EQUAL ?
FEE3 200B	02790		JR	NZ, MORE	; IF NOT EOF THEN
	02800 02810	;*****	****		
	02820	; IF SECT	OR IS Z	ERO USE EOF COUNT	T NOT 256
	02830	;*****	****		
FEE5 3A45FD	02840 02850	;	LD	A (POPCNE)	CET FOR DVTF COUNT
FEE8 6F	02860		LD	A, (EOFCNT) L,A	;GET EOF BYTE COUNT ;INTO HL
FEE9 2600	02870		LD	н,0	
FEEB 2242FD FEEE 189A	02880 02890		LD	(CHRCNT),HL	STORE FOR CHRCNT
107K	02890 02900	;	JR	KEY	
	02910	, *****			
	02920 02920	; NORMAL	256 BYT	E SECTOR COUNT	
	02940			,	
FEFØ 23	02950		INC	HL	; INC SECTOR COUNT
FEF1 2257FD FEF4 210001	02960 02970		LD	(RECNUM),HL	STORE UPDATED VALUE
FEF7 2242FD	02970 02980		LD LD	HL,256 (CHRCNT),HL	; SECTOR DATA CHAR COUNT ; STORE FOR CHRCNT
FEFA 188E	02990		JR	KEY	;EXIT
FF00	03000 03010	;	OBC	appaar.	
1100	03010 03020	,	ORG	0FF00H	
FF00	03030	DISKIO	EQU	\$	
FDOE	03040	;	END	CMADM	
FD96 00000 TOTAL E	03050 RRORS		END	START	
TOTAL TOTAL E					

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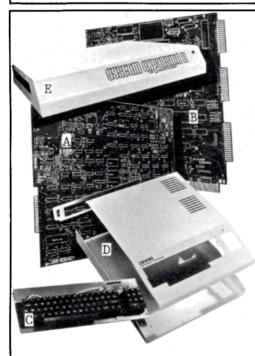


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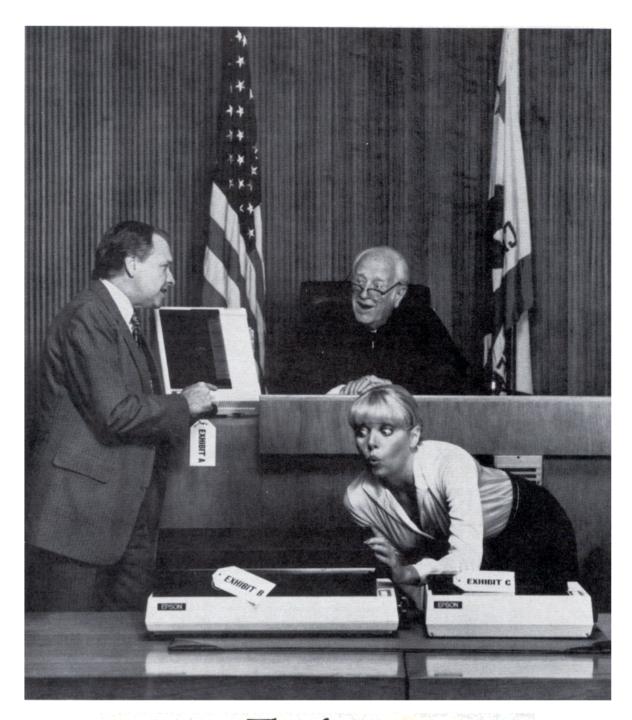
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## A Matter of Compatibility

by Art Huston

## ake your program submissions to 80 Micro compatible with other sytems with this short routine. Your readers will appreciate it.

Imagine the frustration of a first-time reader who types in a long program only to come up with an undefined user function or Level III error. Maybe the author states, "I have a 16K Model I, but this program can easily be changed to work on a 48K Model III with disks." But he doesn't explain further, because he doesn't have the machine to test the change.

#### The Problem

This occurs most often when the program is written in Basic with machinelanguage routines read from data statements and POKEd into RAM. All too often the author only makes provisions for the program run under his system.

For example, let's say an author has a 16K, Level II Model I and he POKEs a routine into high RAM. For a 68-byte routine, he would probably choose to POKE the routine in starting at 32700

and ending at 32767:

10 FOR X = 32700 TO 32767:READ Y:POKE X.Y:NEXT

Then he would tell the Basic interpreter what address to branch to when encountering a USR statement. He would do this by POKEing the address into 16526 and 16527:

20 X = 32700:X2 = X/256:X1 = X - X2\*256: POKE16526,X1:POKE16527,X2

Later in the program he would have a line that would call the machine-language routine:

 $100 \quad X = USR(0)$ 

If a relative newcomer to computers tries to use this program on a 48K Model III under Disk Basic, he will meet up with only frustration and probably give up.

When he runs the program, it will quickly crash with a UL or syntax error. A listing of the program shows that some of the lines are pure gibberish, whereas before the run they were perfectly normal. What happened?

Our newcomer is unaware that Disk Basic takes up space in memory. A program that loads in at 17129 under Level II (17385 for Model III) loads in at around 28000 under Disk Basic. When it POKEs a routine in at 32000, it overwrites itself. The result is a scrambled listing.

The new reader perseveres. He summons a friend and between them they manage to move the POKE routine into high memory for 48K. Line 10 now reads:

10 FOR X = 65468 TO 65535:READ Y:POKE X,Y:NEXT

When the program is run again, the screen says, "Overflow error in 10." The user begins to pull his hair out.

His friend says, "When you POKE above 32767, you have to subtract 65536 from the location you're POKEing." After much trial and error they come up with:

10 FORX = 65468 TO 65535:READ Y:POKE X - 65536,Y:NEXT

This seems to work just fine, and hope begins to dawn for our computer neophyte. Then, suddenly, the computer reports an undefined user function in 100. Faced with this ultimate insult, our user gives up.

How is our would-be computerist to know that a DEFUSR is all that's needed? He only needs to tell the Basic interpreter where the routine is located

```
10 REM ** UNIPOKE **
20 INPUT Number of bytes to POKE";NB
30 Z2=PEEK(16561)+256*PEEK(16562)'Z2=last byte Basic will use
40 Z1=Z2-NB+1'Z1=beginning POKE location
50 Z=Z1-1:Z4=INT(Z/256):Z3=Z-Z4*256:POKE16561,Z3:POKE16562,Z4:
    'last byte used by Basic is one below start of routine
60 FOR Z=Z1 TO Z2:READ ZZ:POKE Z+(Z>32767)*65536,ZZ:NEXT
    'POKE in the routine
70 IFPEEK(16396)=201THEN90 'Test for Cassette Basic
80 DEFUSR=Z1+(Z1>32767)*65536:GOTO100 'Entry to USR for disk
90 Z4=INT(Z1/256):Z3=Z1-256*Z4:POKE16526,Z3:POKE16527,Z4
    'Entry to User for cassette
100 CLEAR50:
    'Clear string space. ROM routine corrects amt. of MEM
    and string storage to agree with 16561,16562
110 '**** Here Begins the Rest of the program ****
```

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and the program will run correctly:

```
20 DEFUSR = 65468 - 65536
```

Let's be kind to this individual and try to ease his way into programming. After all, POKEs, PEEKs, and DEFUSRs are advanced stuff that he won't use for years. The key to helping him is to make the programs as compatible as possible.

#### A Routine for All Systems

A routine that would work with 16K, 32K, or 48K, disk or cassette, Model I or Model III would end the beginner's frustration. Such a routine would check for the top of memory and POKE the routine in. Then it would check for a disk or cassette system and do a DEFUSR or POKE the correct address in. Last, it would reset memory size to protect the machine-language routine.

To do these tasks we need the following information:

- Locations 16561 and 16562 point at the highest memory location usable by Basic on both the Model I and Model III. Changing these locations is equivalent to setting the memory size.
- IF PEEK(16396) = 201 then cassette Basic is in operation, else we are in Disk Basic.
- Cassette Basic on the Model I and III POKEs the starting address of the machine-language routine into 16526 and 16527.
- Disk Basic on the Model I and III uses a DEFUSR statement to determine the start of the machine-language routine.

Program Listing 1, UNIPOKE, is a routine to do all the above. Program Listing 2 is a compressed version, and Listing 3 demonstrates how it works. If you use UNIPOKE to POKE in your machine language, there should be no problems with DEFUSRs or moving POKEs higher or lower.

In Listing 1, line 20 is a dummy line that you should take out of your programs. It simply asks for the number of bytes you wish to POKE into memory. In your programs you should set NB equal to the number of bytes in your machine-language routine.

Line 30 sets Z2 equal to the highest location usable by Basic. Line 40 sets Z1 equal to the address at which to begin POKEing. Z2 will be the last location.

In line 50, Z is set equal to one byte below the routine. Then the value of Z is POKEd into 16561 and 16562. These locations tell Basic the highest location it can use and protect the machine-language routine from being overwritten.

```
10 REM ** UNIPOKE compressed version**
20 INPUT"Number of bytes to POKE";NB
30 Z2=PEEK(16561)+256*PEEK(16562):Z1=Z2-NB+1:Z=Z1-1:Z4=INT(Z/256):Z3=Z-Z4*256:POKE16561,Z3:POKE16562,Z4:FORZ=Z1TOZ2:READZZ:POKEZ+(Z>32767)*65536,ZZ:NEXT
40 IFPEEK(16396)=201THENZ4=INT(Z1/256):Z3=Z1-256*Z4:POKE16526,Z3:POKE16526,Z4ELSEDEFUSR=Z1+(Z1>32767)*65536
50 CLEAR50

Program Listing 2
```

Program Listing 3

Line 60 actually POKEs the routine in. The statement POKE Z + (Z>32767) \*65536,ZZ looks complicated, but isn't. The phrase in the parentheses, Z>32767, is checked to see if it is true or false. If it is false, it has a value of 0 and the entire statement reduces to POKE Z,ZZ. If it is true, it has a value of -1 and the statement reduces to POKE Z-65536,ZZ. This routine is used to handle POKEs above 32767.

Line 70 checks PEEK(16396) to see if it is operating in cassette Basic. If so, the program jumps to 90.

Line 80 tells Disk Basic where to find the machine-language routine. Line 90 does the same for cassette Basic.

Line 100 clears string space. It must be a CLEARnnn statement, not just Clear. This allows the Basic interpreter to check the contents of 16561 and 16562 and adjust other pointers accordingly. It also frees up all variable space, so that the variables in UNIPOKE will not take up any room.

#### Restrictions and Alternatives

This routine respects the top-ofmemory setting when you enter Basic—it will not overwrite anything already in high memory (like a keyboard debounce routine). This means, however, that each time the routine is executed it will set the top of memory lower and lower, eventually resulting in an out-of-memory error. If you use Run to restart a program, be sure it is Run nnnn, where nnnn is the first line number after this routine.

Using this routine will ensure that program users will not have to relocate machine language, change DEFUSRs to POKEs, or POKEs to DEFUSRs. It will make your program user-oriented in the best sense of the word.

This routine will not make all programs compatible with all systems. It will not make a program with disk input/output work correctly on a cassette system. If a Model I machine-language routine calls locations in ROM, it may crash on the Model III. Changes like these will always require you to tinker.

Programs that POKE the machine language into strings or into remark statements will only need lines 70-90 of UNIPOKE. These lines simply do a DEFUSR or POKEs, depending on whether the system is cassette or disk. In line 60, set Z1 equal to the location of the machine-language routine.

If you don't include this routine at the beginning of your program, include the changes for other systems somewhere in your article.

Art Huston is a technical editor for 80 Micro.





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## Tracking Lobster

by William F. Kaczor

Searching for lobster-pot buoys in ideal conditions is hard enough—forget it in bad weather. Not only that, but trying to remember where the pots are, when they were last hauled, what the catch was, and how good the catch was is no easy task when you have almost 100 pots spread over four square miles of ocean.

#### A Better Way

Now my micro catches the lobsters. Well, not physically, but it does make lobster catching much easier.

Prior to this series of programs, my friend had been relying on his memory to keep track of how well each area was doing and where his pots were. (In "lobsterese," a pot is a trap set on the ocean bottom. This pot, or a string of pots tied together, is tied to a floating buoy marking its location.)

Also left to his memory was how good or bad the catch was in each area, the total caught for the day, and when the area was last worked. I was sure the computer's memory could do a much better job.

#### Laying the Ground Rules

We decided the micro should generate a map of each area where he works his pots (six areas). Each map should show all navigational buoys and

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markers, compass headings, and, of course, where the pots are. The maps will also show the types of pots (single wire, double wire, wood) and the serial number of each pot.

The program should provide a tabulated printout grouped together by each of the six areas, which lists the following:

- It shows all the pots in that area, showing the code for each pot (explained later), the amount of "shorts" (lobsters too small) in each pot, the amount of "keepers" (legal-sized lobsters) in each pot, the total for the area, the percentage of keepers versus total pots worked for each area. Some of this data will be used for migration tracking and prediction of the most active areas.
- This printout also shows a total of keepers and shorts for all six areas combined, date worked, and a year-to-date total of keepers and shorts for all areas.
- If there is no data available for a given area, the printout should indicate it.

The program should also produce a bar-graph printout showing keepers and shorts per area for each date worked.

#### **Developing the Program**

The program runs slowly, not because of Basic, but because my Centronics 737 printer is slow. Although it is not a graphics printer, all the neces-

sary map features are recognizable. To circumvent its slowness, I set the program up so that once the week's data is entered, the whole process runs without operator intervention until complete.

The final outcome is nine separate programs producing eight printouts. Each program runs the next in proper order. All that is required of the operator is to enter the initial data, set the printer to the top of the page, and start the program.

#### Computer-generated Maps

We used a pantograph to scale the actual marine maps to fit on single-sheet, tractor-feed printer paper. I set up a grid of 64 by 80 columns to aid in the programming design of each map. To ease the weekly entering of data coordinates for each pot, we divided each map into 20 sections labeled A-T (the printer outlines each sector with dots and labels each one) and allocated 20 possible pot positions in each section. That's 400 possible pot locations per map, six maps total.

Also included was the date, map and island titles, and to make things pretty, the name of the business (I changed the name in the example for privacy). See Figs. 1-6 for a look at each map. We included all necessary navigational beacons and markers along with arrow compass heading pointing north.

#### The Pots

Each pot has a serial number. There are three different types of pots: single wire, double wire, and wood (coded SW, DW, and W respectively). We attach a location code to each pot showing what sector and position within the sector each pot is in. A pot code might read C10DW36, meaning sector C, pot

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position 10, double wire, serial number 36. When printed on the map, it's shown with an asterisk, \*C10DW36.

As each map is printed, the program checks the data file for that map, and by the code assigned to each pot, prints the pot in its proper place on the map.

#### **Entering Data**

I wrote a file editor to modify data files. A typical session at each map area includes loading last week's data, entering the current date, telling the editor to set the keepers/shorts file to zero (previous data had already been added to the year-to-date file at the end of the last run).

Now, with a new file date, we delete or move any pots necessary, then enter the new date, keepers/shorts for each pot.

When writing the editor, I used IN-KEY\$ as much as possible—the fewer the keystrokes the better. A listing to screen, showing the pots in each area and pot codes, aids in the efficient update of each file.

After entering each map's data, the file is saved to disk for later use. When all six map files have been updated, we start the first print routine and then go about our business. The routine will now run itself: printing out each map while accessing the proper data file putting the pots on each map in the proper location; printing out a copy of all the pot information on a tabulation sheet showing each pot code, shorts, keepers, and percentage caught versus traps worked, totals for each area, and year-

to-date totals; printing out a bar graph of the shorts versus keepers for each map. This allows us, at a quick glance, to see how each area is doing.

#### Success

Now it's easy to locate traps. We can study the maps, data printouts, and bar graph to see what areas are producing and which are not. Then decisions can be made for moving pots into other areas.

We hope to see migration trends from the gathered data or at least try to predict which areas to move the pots to and increase the catch.

My friend says life is much easier now. He spends much less time hunting for pots. On bad days when he can't go out, he studies his data.

#### Program Listing 1

```
3 CLEAR3288:ON ERROR GOTO 3558:DEFSTRV,H,M,D,A:DEFINTU,B,O,X:DIM 25(28,28):M="8":A="1":v="1":H=".":CL5:PRINTe465, "MORRING FILENAM E...",CLR$(34): BAKERS",CLR$(34):GOSUB3588:GOTO8
5 LPRINTTAB(1)D1;TAB(18)D2;TAB(19)V,TAB(21)D3;TAB(38)D4;TAB(39)V,TAB(41)D5;TAB(58)D6;TAB(59)V,TAB(61)D7;STRING$(78-PEEK(16539),32)D8:RETURN
   2); D8: RETURN
7 LPRINTAB(19) V; TAB(39) V; TAB(59) V; RETURN
8 GOSUB7: LPRINTSTRING$ (88,H): GOSUB2888: S-1: L-1
18 LPRINT"(A) "TAB(3)" ", TAB(19) V; "(B) ", TAB(39) V; "(C)"; TAB(59) V;
"(D)": U1-8: GOSUB1888
28 LPRINTAB(2) ", TAB(18) D2: TRR(19) V; " D3: TAB(38) D4: TAB(38)
29 LPRINTAB(2) ", TAB(38) D4: TAB(38)
                        RINTTAB(2) "IIII";TAB(10)D2;TRB(10)V;" "D3;TAB(30)D4;TAB(39)
"D5;TAB(50)D6;TAB(50)V;" "D7;STRING$(70-PEEK(16539),32);D8:G
   OSUB1606
   OSUBISSS
36 LPRINTTAB(4)"I"; TAB(18)D2; TAB(19)V; "D3; TAB(38)D4; TAB(39)V; "D5; TAB(58)D6; TAB(59)V; "D7; STRING$(78-PEEK(16539), 32); D8:U5-8:U6-8:GOSUB1888
136 - GOSUB1888 189 | TAB(19) V1 TAB(39) V2 | TAB(39) V3 | G| | TAB(19) V3 | G| | TAB(19) V3 | TAB(19) V4 | TAB(19) V5 | T
  ",DB:GOSUB1888
218 GOSUB3888:LPRINTTAB(39)V;N;STRINGS(67-PEEK(16539),32);N;" "
  DB:GOSUB1080

228 GOSUB1080:LPRINTTAB(39)V; ";N;STRING$(66-PEEK(16539),32);N;
";DB:GOSUB1080

238 GOSUB1080:LPRINTTAB(39)V; ";N;STRING$(67-PEEK(16539),32);N;
";N;STRING$(67-PEEK(16539),32);N;
   240 LPRINTSTRING$(39,H); N; N; N; TAB(48) "BAKERS ISLAND"; STRING$(68-PEEK(16539), 32); N; STRING$(11,H); GOSUB2600: S-3:L-1
250 LPRINT"(1)", TAB(19) V; "(J)"; TAB(37) N; N; STRING$(69-PEEK(16539), 32); N; "(L)": UB-0: US-0: US-0: GOSUB1000
   ,32);N;"(L);"10==1U)==1U/==1U/==1USUBL===
266 GOSUB3086:LPRINTTAB(39);N;N;TAB(59)DATE$;STRING$(69-PEEK(16
539),32);N;N:U2=8:GOSUB1000
   276 LPRINT" "D1;TAB(12)" * C3";TAB(19)V; "D3;TAB(36);D4;TAB(46)M;STRING$(68-PEEK(16539),32);M;M;U8-1:U2-1:GOSUB1888
288 GOSUB3888:LPRINTTAB(39)M;STRING$(67-PEEK(16539),32);M;M;" "D
     8 · GOSTIB1 BAA
     296 GOSUB3666: LPRINTTAB(38) M; STRING$(65-PEEK(16539),32); M; M;
   *,D8:COSUB1888
388 GOSUB3888:LPRINTTAB(38) N;TAB(62) N;N;N;N;STRING$(78-PEEK(1653
   36% GOSUB3680;LPRINTTAB(36)N;TAB(52)N;N;N;N;N;N;N;STRING$(78-PEEK(16 539),32);D8:U7=1:GOSUB1686  
318 GOSUB3680;LPRINTTAB(38)N;TAB(58)N;N;N;N;N;STRING$(78-PEEK(16 539),32);D8:U7=1:GOSUB1686  
328 GOSUB3669:LPRINTTAB(38)N;TAB(57)N;N;V; "D7;STRING$(76-PEEK(
    16539),32);D8:GOSUB1888
338 GOSUB3888:LPRINTTAB(38)M;TAB(56)M; "!V;" "D7;STRING$(78-PE
    EK(16539),32);DB:GOSUB1898
348 GOSUB3898:LPRINTTAB(37)N;TAB(55)N;" ";V;" ";D7;STRING$(78-PEEK(16539),32);DB:GOSUB1898
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358 GOSUB3606:LPRINTTAB(38)M;M;TAB(54)M;" (K)";V;" ";D7;STRING$(
   78-PEEK(16539),32),D8:GOSUB1000
368 LPRINTSTRING$(40,H);N;TAB(54)M;STRING$(25,H):GOSUB2000:U5-0:
368 CURINTSTRINGS(48,H);M;TAB(54)M;STRINGS(25,H):GOSUB2088:U5-0: U6-0:S-4:L-1
378 LPRINT"(M)";TAB(19)V;"(N)";TAB(39)V;"";M;TAB(47)M;"";M;M;M;"";-(O)";TAB(59)V;"(P)":GOSUB1080
388 GOSUB3080:LRINTTAB(39)V;"";M;"";M;M;"";M;"";M;T"",M;TAB(59)V;"";D7;STRINGS(70-PEEK(16539),32);D8:U6-1:GOSUB1080
398 GOSUB300:LPRINTTAB(39)V;"";M;M;"";M;M;TAB(50)D6;TAB(59)V;"";D7;STRINGS(70-PEEK(16539),32);D8:GOSUB2080:GOSUB1080
480 GOSUB5:GOSUB1000
480 GOSUB5:GOSUB1000
420 GOSUB5:GOSUB1000
430 GOSUB5:GOSUB1000
430 GOSUB5:GOSUB1000
440 GOSUB5:U1-0:U2-0:GOSUB1000
    439 GOSUB5:GOSUB1889
448 GOSUB5:GUZ=8:GOSUB1889
458 LPRINTTAB(5)M;TAB(19)V; "D3;TAB(38)D4;TAB(39)V; "D5;TAB(58)D6;TAB(59)V; "D5;TAB(58)D6;TAB(59)V; "D5;TAB(58)D6;TAB(59)V; "D5;TAB(38)D4;TAB(39)V; "D3;TAB(38)D4;TAB(39)V; "D3;TAB(38)D4;TAB(39)V; "D3;TAB(38)D4;TAB(38)V; "D5;TAB(58)Q6;TAB(59)V; "D3;TAB(58)Q6;TAB(58)V; "D5;TAB(58)Q6;TAB(58)V; "D5;TAB(58)D4;TAB(38)D4;TAB(38)V; "D5;TAB(58)D4;TAB(38)D4;TAB(38)V; "D5;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(58)D4;TAB(
    2);D8:GOSUB1866
478 LPRINT*(---;" ";N;TAB(19)V;" "D3;TAB(39)D4;TAB(39)V;" "D5;T
AB(59)D6;TAB(59)V;" "D7;STRING$(70-PEEK(16539),32);D8:GOSUB2888
488 LPRINTSTRING$(80,B):S=5:L=1
499 LPRINT*(Q)";TAB(19)V;"(R)";TAB(39)V;"(S)";TAB(59)V;"(T)":GOS
    IIR1 666
      UBI000
580 GOSUB5:U3-8:GOSUB1000
510 LPRINT" "D1;TAB(10)D2;TAB(18)H;H;" "D3;TAB(30)D4;TAB(39)V;"
"D5;TAB(50)D6;TAB(59)V;" "D7;STRING$(70-PEEK(16539),32);D8:GOSUB
   1888
528 LPRINT" "D1;TAB(18)D2;TAB(17)M;" ";M;" NORTH";TAB(38)D4;TAB
(39)V;" "D5;TAB(58)D6;TAB(59)V;" "D7;STRING$(78-PEEK(16539),32);
D8:U4-6:GOSUB1898
538 LPRINT" "D1;TAB(18)D2;TAB(17)M;" ";M;" GOOSEBERRY";TAB(39)V
;" "D5;TAB(58)D6;TAB(59)V;" "D7;STRING$(78-PEEK(16539),32);D8:GO
      ; D5,
SUB1999
   SUB1888
548 LPRINT" "D1; TAB(18) D2; TAB(18) M; "; M; "ISLAND"; TAB(39) V; "
D5; TAB(58) D6; TAB(59) V; "D7; STRING$(78-PEEK(16539), 32); D8: GOSUB2
888: GOSUB1888
558 LPRINT" "D1; TAB(18) D2; TAB(18) M; M; M; "D3; TAB(38) D4; TAB(39) V; "D5; TAB(58) D6; TAB(59) V; "D7; STRING$(78-PEEK(16539), 32); D8: GOS
      568 GOSUB5:GOSUB1000
570 GOSUB5:GOSUB1000
580 GOSUB5:GOSUB1000
 588 GOSUB5:GOSUB1808
598 GOSUB5:GOSUB1808
688 LPRINTSTRING$(80,H):GOSUB7:GOTO 4000
1800 REM ASSIGN D1>D0 HERE....
1810 IFL=1THENB1=1:B2=20ELSEIFL=2THENB1=2:B2=19ELSEIFL=3THENB1=3:B2=18ELSEIFL=4THENB1=4:B2=17ELSEIFL=5THENB1=5:B2=16
1820 IFL=6THENB1=6:B2=15ELSEIFL=7THENB1=7:B2=14ELSEIFL=8THENB1=8:B2=13ELSEIFL=9THENB1=18:B2=13ELSEIFL=8THENB1=8:B2=13ELSEIFL=9THENB1=18:B2=11
1830 IFS=1THENO1=0:02=1:03=2:04=3:GOTO10808
1840 IFS=2THENO1=3:02=4:03=5:04=6:GOTO10808
1850 IFS=3THENO1=6:02=7:03=8:04=9:GOTO10808
1850 IFS=3THENO1=5:02=6:03=11:04=12:GOTO10808
1870 01=12:02=13:03=14:04=12:GOTO10808
1870 01=12:02=13:03=14:04=12:GOTO10808
1870 01=12:02=13:03=14:04=12:GOTO10808
1870 01=2:02=13:03=14:04=15:03=14:04=12:GOTO10808
1870 01=2:02=13:03=14:04=15:03=14:04=12:GOTO10808
1870 01=12:02=13:03=14:04=15:03=14:04=12:GOTO10808
1870 01=12:02=13:03=14:04=15:03=14:04=12:GOTO10808
1870 01=12:02=13:03=14:04=15:03=14:04=12:GOTO10808
1870 01=12:02=13:03=14:04=15:03=14:04=12:GOTO10808
1870 01=12:02=13:03=14:04=15:03=14:04=12:GOTO10808
1870 01=12:02=13:03=14:04=15:03=14:04=12:GOTO10808
1870 01=12:03=14:04=15:03=14:04=12:GOTO10808
1870 01=12:03=14:04=15:03=14:04=12:GOTO10808
1870 01=12:03=14:04=15:03=14:04=12:GOTO10808
1870 01=12:03=14:04=15:03=14:04=12:GOTO10808
1870 01=12:03=14:04=15:04=12:GOTO10808
1870 01=12:03=14:04=15:04=12:GOTO10808
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   1095 D1=E$(1):D2=E$(2):D3=E$(3):D4=E$(4):D5=E$(5):D6=E$(6):D7=E$
    1895 D1=E$(1);D2=E$(2);D3=E$(3);D4=E$(4);D3=E$(5);D6=E$(6);I
(7);D8=E$(8);L=L+1;RETURN
2898 U1=1:U2=1:U3=1:U4=1:U5=1:U6=1:U7=1:U8=1:RETURN
3898 LPRINT" "D1;TAB(18)D2;TAB(19)V; "D3;TAB(38)D4;:RETURN
3588 OPEN1",1,*BAKERS/DAT*;INPUT4];DATES
3518 FORX=1T028;FORX1=1T028;INPUT4];2$(X,X1);NEXTX1:NEXTX
      3528 CLOSE:RETURN
3559 CLOSE:END
4868 LPRINTSTRING$(3,138):RUN"CAT"
```

#### Program Listing 2

```
1 ONERRORGOTO3656:CLEAR3288:DEPSTRV,H,M,D,A:DEPINTU,B,O,X:DIMZ$(28,28):M=-8*:A-I*:V=:":":H=-":":LS:PRINTe465,"MORKING FILEMAME...-";CLR$(34):"CLR$(34):GOSUB368:GOTO9
  2. PRINTTAB(1)D1; TAB(18)D2; TAB(19)V; RETURN
3. LPRINTTAB(19)V; "D3; TAB(39)D4; TAB(39)V; "D5; TAB(58)D6; TAB(59)V; "D5; TAB(58)D6; TAB(59)V; "D7; STRINGS(78-PEEK(16539), 32); D8: RETURN
4. LPRINTTAB(41)D5; TAB(58)D6; TAB(59)V; "D7; STRINGS(78-PEEK(16539)
      .32) : D8 : RETURN
  ),32);D0:RETURN
5. LPRINTTAB(10);TAB(10)D2;TAB(19)V;" "D3;TAB(30)D4;TAB(39)V;" "
D5;TAB(50)D6;TAB(59)V;" "D7;STRINGS(70-PEEK(16539),32);D8:RETURN
      LPRINTTAB(1)D1;TAB(18)D2;TAB(19)V; "D3;TAB(38)D4;:RETURN
LPRINTTAB(39)V; "D5;TAB(58)D6;TAB(59)V;:RETURN
COSUB6;COSUB7:RETURN
LPRINTTAB(19)V;TAB(39)V;TAB(59)V:LPRINTSTRINGS(88,H):GOSUB2888
  :U2=8:GSUB1988
18 LPRINT*(A) TAB(8) A; TAB(19) V; "(B) "; TAB(39) V; "(C) "; TAB(59) V; "(D) ":S-1:L-1:GOSUB1988:GOTO28
  11 LPRINTTAB(58)D6; TAB(59)V; "D7; STRING$(78-PEEK(16539),32); D8:
  RETURN
   20 LPRINTTAB(1)D1;TAB(8)A;A;:GOSUB3:GOSUB1000
  38 LPRINTTAB(1)D1;TAB(9)A;:GOSUB3:U7-8:U8-8;GOSUB1000
40 LPRINTTAB(1)D1;TAB(19)V; ";D3;TAB(30)D4;TAB(39)V; "D5;TAB(50)D6;TAB(59)V;STRING$(67-PEEK(16539),32); "*C5":U7-1:U8-1:GOSUB10
 58 LPRINTTAB(1)D1;TAB(18)A;:GOSUB3:GOSUB1888
68 LPRINTTAB(1)D1;TAB(18)A;:GOSUB1888
68 LPRINTTAB(1)D1;TAB(11)A;:GOSUB3:GOSUB1888
88 FORC=1TO4:GOSUB5:GOSUB1888:MEXTC:LPRINTSTRINGS(88,H):LPRINT*(E)*;TAB(19)V;*(F)*;TAB(39)V;*(G)*;TAB(59)V;*(H)*:S=2:L=1:GOSUB28
 ###:GOSUBLE###
14# GOSUBS:U4=#:GOSUB1###
15# GOSUBZ:LPRINTTAB(21)D3;TAB(28)M;M;" ";M;M;M;M;TAB(39)V;:GO
   SURA - GOSUB 1 AAA
   160 GOSUB2:LPRINTTAB(27) M; TAB(30) M; TAB(36) M; TAB(39) V; :GOSUB4:U5=
  0:GOSUB1000
  176 GOSUB2:LPRINTTAB(23) M;M;M;M;TAB(35) M;TAB(39) V;M;M;TAB(58) D6;
TAB(59) V; " "D7;STRING$(78-PEEK(16539),32);D8:GOSUB1600
188 GOSUB2:LPRINTTAB(22) M;TAB(36) M;TAB(39) V;M;" ";M;M;:GOSUB11:G
  OSUB1666
 OSUB1888
198 GOSUB2:LPRINTTAB(23) N;TAB(36) M;N;TAB(39) V;TAB(41) N;N;N;;GOSU
Bll:US-1:GOSUB1888
288 GOSUB2:LPRINTTAB(24) N;TAB(38) N;N;:GOSUB4:GOSUB1888
218 GOSUB2:LPRINTTAB(25) N;TAB(27) "CAT ISLAND";TAB(39) N;:GOSUB4:G
 OSUB1888
228 GOSUB2:LPRINTTAB(24) M; TAB(48) M; TAB(42) D5;:GOSUB11:U5=8:GOSUB
  238 GOSUB2:LPRINTTAB(25)M;M;TAB(38)DATE$;TAB(41)M;M;M;M;;:GOSUB11
238 LPRINTSTRINGS(27,H);M;M;M;M;M;AB(44)M;M;STRINGS(33,H)
258 LPRINTSTRINGS(27,H);M;M;M;M;M;M;M;TAB(46)M;" (K)";TAB(59)
)V;"(L)":GOSUB2289:U4-09:U5-09:S-3:L-1:GOSUB1080
268 GOSUB2:LPRINTTAB(21)D3;TAB(33)M;TAB(47)M;:GOSUB11:U2-0:GOSUB
276 LPRINTTAB(1)D1;TAB(15)M;M;TAB(19)V; "D3;TAB(34)M;M;M;M;M;M;TAB(48)M;:GOSUB11:U4-1:GOSUB1888
288 LPRINTTAB(1)D1;TAB(15)M;M;TAB(19)V; "D3;TAB(38)D4;TAB(39)M;
TAB(48)M;:GOSUB1:U2-1:GOSUB1888
296 GOSUB2:LPRINTTAB(21)D3;TAB(38)D4;TAB(48)M;TAB(48)M;M;TAB(51)D6;TAB(59)V; "D7;STRING$(78-PEEK(16539),32);D8:U1=8:U7=8:GOSUB1888
 388 LPRINT" RN2";TAB(18)D2;TAB(19)V;" "D3;TAB(38)D4;TAB(38)M;M;M
;TAB(58)M;" ";D6;TAB(58)M;M;M;STRINGS(78-PEEK(16539);32);D8;U6-8
 :U2=U;GUSUB1800
318 LPRINT"(---";TAB(12)N;N;TAB(19)V;" "D3;TAB(30)D4;TAB(38)N;" ";N;TAB(51)N;TAB(57)N;TAB(61)N;TAB(63)" ";N;N;N;N;N" "D8;U1=1:GO SUB1800
 328 LPRINTTAB(1)D1;TAB(11)H;" ";H;TAB(19)V;" "D3;TAB(30)D4;TAB(3
9)V;" "H;TAB(52)H;H;H;H;H;TAB(62)H;" ";H;" ";H;H;" ";D8:GOSUB10
330 LPRINTTAB(1)D1;TAB(10)N;TAB(13)N;TAB(19)V; "D3;TAB(30)D4;TAB(39)V;TAB(42)N;TAB(31)N; "N;N;N;" "D8;U8=8;GOSUB1800
348 LPRINTTAB(1)D1;TAB(11)N;M; ";N;N;" "D8;U8=8;GOSUB1800
349 LYTAB(42)N;TAB(43)N;TAB(11)N;M; ";N;TAB(19)V; "D3;TAB(30)D4;TAB(33)V;TAB(34)N;TAB(34)N;TAB(34)N;TAB(35)V;TAB(35)N;N;TAB(35)N;N;TAB(35)N;N;TAB(35)N;N;TAB(35)N;N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35)N;TAB(35
TAB(63) M," ", M, M," ", D8:U4=1:GOSUB1888

398 GOSUB6:LPRINTTAB(39) V, TAB(45) M, M," ", M, TAB(54) M," ", M, TAB(63) ", M, M, M," ", D8:GOSUB1888

488 GOSUB6:LPRINTTAB(39) V, TAB(45) M, M, TAB(58) M, M, TAB(54) M, TAB(57) M, STRING$(68-PEEK(16539), 32), M," ", D8:GOSUB1888

488 GOSUB6:LPRINTTAB(39) V, TAB(52) M, M, TAB(58) M, M, M, M, STRING$(67-PEEK(16539), 32), M," ", D8:U5=1:U6=1:GOSUB1888

428 GOSUB8:LPRINTTAB(61) M, STRING$(66-PEEK(16539), 32), M, M, M, M, ", ", D
 8:GOSUB1666
  438 GOSUB8: LPRINTM; STRING$ (66-PEEK (16539), 32); M; "
                                                                                                                                                                  ";D8:GOSUB16
  448 GOSUB8: LPRINTM; STRING$(65-PEEK(16539),32); M; *
                                                                                                                                                                     ";D8:GOSUB1
 459 GOSUB8:LPRINTTAB(61)M;M;M;M;" ";M;M;" ";D8:GOSUB1000
468 GOSUB8:LPRINTSTRING$(66-PEEK(16539),32);M;M;" ";D8:GOSUB100
 476 GOSUB8:LPRINTSTRING$(78-PEEK(16539),32);D8
488 LPRINTSTRING$(88,H):LPRINT"(Q)";TAB(19)V;"(R)";TAB(39)V;"(S)
"TAB(59)V;TAB(63)M;M;M;" (T)":GOSUB2888:U7-8:U8-8:S-5:L-1:GOSU
588 GOSUB8:LPRINTTAB(62)M; ";M;M;";D8:GOSUB1888
518 GOSUB8:LPRINTTAB(62)M;STRING$(68-PEEK(16539),32);M;M;M;"";D
8:08-8:GOSUB1888
 520 GOSUB8: LPRINTTAB(62) M; M; M; STRING$(71-PEEK(16539), 32); M; GOSUB
 538 GOSUB8:LPRINTTAB(63) " ";M;STRING$(71-PEEK(16539),32);M:U8=1:
GOSUB1600
548 GOSUB8:LPRINTSTRING$(65-PEEK(16539),32)M;
                                                                                                                                                            ",M;" ",D8:U8=
0:GOSUB1000
            GOSUB8: LPRINTSTRING$(66-PEEK(16539),32)M;
                                                                                                                                                            ";M:U8=1:GOSUB
1000
 560 GOSUB8: LPRINTSTRING$ (66-PEEK (16539), 32) M; *
                                                                                                                                                        ";M;" ";D8:U7=1
```

```
578 GOSUB8:LPRINTTAB(61)D7;STRING$(67-PEEK(16539),32)M;M;M;"";
D8:GOSUB2080:GOSUB1080
588 GOSUB5:GOSUB1080
590 GOSUB5:GOSUB1080
690 LPRINTSTRING$(80,H):LPRINTTAB(19)V;TAB(39)V;TAB(59)V:GOTO480
8
1808 REM LOAD D1>D8 HERE
1810 IFL=1THENB1=1:B2=20ELSEIFL=2THENB1=2:B2=19ELSEIFL=3THENB1=3
1B2=18ELSEIFL=4THENB1=4:B2=17ELSEIFL=7THENB1-7:B2=16:
1B20 IFL=6THENB1=6:B2=15ELSEIFL=7THENB1-7:B2=14ELSEIFL=8THENB1=8
1B2=13ELSEIFL=9THENB1=9:B2=12ELSEIFL=1THENB1=10:B2=11
1B30 IFS=1THEND1=0:Q2=103-2:Q4=3:GOTO1080
1840 IFS=2THEND1=0:Q2=103-2:Q4=0:GOTO1080
1850 IFS=3THEND1=0:Q2=10:Q3=10:Q4=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=10:Q5=
```

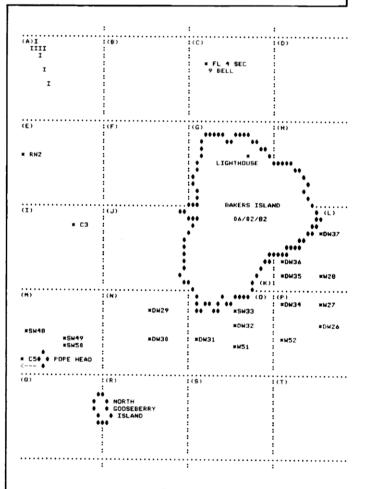


Figure 1

#### Program Listing 3

```
CLEAR3288:ON ERROR GOTO 3858:DEFTRV,H,D,A:DEFINTU,B,O,X:DIM
IS(28,28):M="0":A="1":V"=":":H=".":CLS:PRINT0465, "WORKING FILENAM
E....";CHRS(34); "EAGLE";CHRS(34):GOSUB3000:GOTO8
LPRINTTAB(19)V; ""D3;TAB(30)D4;TAB(39)V; "D5;TAB(50)D6;TAB(59)
V; "D7;STRINGS(70-PEEK(16539),32);D8:RETURN
LPRINTTAB(39)V; "D5;TAB(50)D6;TAB(59)V; "T7;STRINGS(70-PEEK(16539),32);D0:RETURN
LPRINTTAB(39)V; "D7;STRINGS(70-PEEK(16539),32);D0:RETURN
LPRINTTAB(1)D1;TAB(10)D2;TAB(19)V; "D3;TAB(30)D4;TAB(39)V; "D5;TAB(50)D6;TAB(50)V; "D7;STRINGS(78-PEEK(16539),32);D0:RETURN
LPRINTTAB(1)D1;TAB(10)D2;TAB(19)V;:RETURN
LPRINTTAB(1)D1;TAB(10)D2;TAB(19)V;:RETURN
LPRINTTAB(1)D1;TAB(39)V;TAB(59)V:LPRINTSTRINGS(80,H):GOSUB2000
Listing 3 continues
```

```
Listing 3 continued
                                                                                                                                                                                                                                                                                                                                                                                                              ;(C) ;(D)
                                                                                                                                                                                                                                                                                                                                                                                               : (B)
18 LPRINT"(A) "; TAB(19) V; "(B) "; TAB(39) V; "(C) "; TAB(59) V; "(D) ": U1=0
1
                                                                                                                                                                                                                                                                                                                                                              т
                                                                                                                                                                                                                                                                                                                                                                                                                                                                              :(G)
         W.GOSUBIASS
GOSUB7: LPRINTTAB(21)D3; TAB(35)M;M;STRING$(71-PEEK(16539),32)
 ;M:GOSUB1808
188 GOSUB7:LPRINTTAB(21)D3;TAB(33)M;M;STRING$(69-PEEK(16539),32)
 198 GOSUB7:LPRINTTAB(21)D3;TAB(31)N;M;STRING$(67-PEEK(16539),32);M;M; " "D8:GOSUB198
                                                                                                                                                                                                                                                                                                                        RN2
                  GOSUB7: LPRINTTAB(21)D3; TAB(30)M; STRING$(65-PEEK(16539),32)M;
 N; " 108:GOSUB1666
218 GOSUB7:LPRINTTAB(21)D3;TAB(28)N;N;TAB(63)N;N;STRING$(78-PEEK
 (16539),32);D8:GOSUB1090
220 GOSUB7:PRINTTAB(27) M;TAB(61) M;M;STRING$(70-PEEK(16539),32);
D8:GOSUB1090
  238 GOSUB7:LPRINTTAB(25) M; M; TAB(59) M; M; STRING$(70-PEEK(16539),32
     +DB+GOSUB1###
 );D6:GOSUB1898
248 LPRINTSTRINGS(23, B);N;N;TAB(58)N;STRINGS(28, B):S=3:L=1
258 LPRINT*(1)*;TAB(19)V;"";N;N;TAB(57)N;"";V;"(L)*:GOSUB2808:
U3-8:U4-8:U5-8:U6-8:GOSUB1808
266 LPRINTTAB(1)D1;TAB(18)D2;TAB(18)N;N;TAB(56)N;:GOSUB4:GOSUB
                                                                                                                                                                                                                                                                                                                                                                                                        ≖DH3
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       ×DW5
  1998
276 LPRINTTAB(1)D1;TAB(16)D2;TAB(16)M;M;TAB(55)M;"(K)";V;" "D7;S
TRING$(78-PEEK(16539),32);D8:U2-8:GOSUB1808
286 LPRINTTAB(1)D1;TAB(13)M;M;M;TAB(54)M;:GOSUB4:GOSUB1808
296 LPRINTTAB(1)D1;TAB(18)M;M;M;TAB(53)M;:GOSUB4:GOSUB1808
308 LPRINTTAB(1)D1;TAB(8)M;M;TAB(52)M;:GOSUB4:U1-8:GOSUB1808
318 LPRINTTAB(5)M;M;M;TAB(22)"EAGLE ISLAND";TAB(59)M;M;:GOSUB4:G
                                                                                                                                                                                                                                                                                                                                                                                                 : (R)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 : (8)
    OSUB1886
 328 LPRINTTAB(4)M,TAB(49)M;:GOSUB4:U6-1:GOSUB1000
330 LPRINTTAB(3)M;TAB(22)DATES;TAB(48)M;TAB(50)D6;:GOSUB4:GOSUB1
 338 LPRINTTAB(3)N;TAB(22)DATES;TAB(48)N;TAB(59)D6;:GOSUB4:GOSUB1
888
348 LPRINTTAB(4)N;TAB(46)N;N;TAB(59)D6;:GOSUB4:GOSUB1898
359 LPRINTTAB(4)N;TAB(44)N;N;TAB(59)D6;:GOSUB4:GOSUB1898
350 LPRINTB;N;H;N;TAB(34)N;N;TATR(53)D6;:GOSUB4:GOSUB1898
360 LPRINTB;N;H;N;TAB(39)N;N;N;TG(5)D6;:GOSUB4:GOSUB1898
370 LPRINTTAB(3)N;TAB(37)N;N;TAB(59)D6;:GOSUB4:GOSUB1898
380 LPRINTTAB(3)N;TAB(37)N;N;TAB(59)D6;:GOSUB4:GOSUB1898
480 LPRINTTAB(4)N;TAB(33)N;M;"(N)";:GOSUB3:GOSUB1898
481 LPRINTTAB(4)N;TAB(33)N;M;"(N)";:GOSUB3:GOSUB1898
482 LPRINTTAB(4)N;TAB(32)N;TGOSUB3:GOSUB1898
483 LPRINTTAB(4)N;TAB(31)N;TGOSUB3:GOSUB1898
484 LPRINTTAB(10)N;TAB(39)N;TGOSUB3:GOSUB1898
485 LPRINTTAB(10)N;TAB(29)N;TAB(31)D4;TGOSUB3:GOSUB1898
486 LPRINTTAB(10)N;TAB(28)N;TAB(39)D4;TGOSUB3:GOSUB1898
487 LPRINTTAB(10)N;TAB(27)N;TAB(39)D4;TGOSUB3:GOSUB1898
488 LPRINTTAB(11)N;TAB(27)N;TAB(39)D4;TGOSUB3:GOSUB1898
489 LPRINTTAB(11)N;TAB(27)N;TAB(39)D4;TGOSUB3:GOSUB1898
480 LPRINTTAB(11)N;TAB(25)N;TAB(30)D4;TGOSUB3:GOSUB1898
480 LPRINTTAB(11)N;TAB(27)N;TAB(25)N;STRINGS(53;R):S-51L=1
498 LPRINTTAB(10)D;TAB(11)N;TAB(21)N;N;N;N;TAB(39)V;"(S)";TA
B(59)V;"(T)";TGOSUB2898:U2=8;U3=8;COSUB1898
518 LPRINTTAB(10)D;TAB(11)N;TAB(21)N;N;N;TAB(38)N;TAB(38)D4;TGOSUB
518 LPRINTTAB(10)D;TAB(11)N;N;N;TAB(38)N;TAB(38)D4;TGOSUB
518 LPRINTTAB(10)D;TAB(11)N;N;N;TAB(18)N;N;TAB(38)D4;TGOSUB
518 LPRINTTAB(10)D;TAB(11)N;N;N;TAB(13)V;TAB(59)V;TOTOTOTGGOSUB;GOSUB1898
518 LPRINTTAB(10)D;TAB(11)N;N;N;N;TAB(139)V;TAB(59)V;GOTO4898
518 LPRINTTAB(10)D;TAB(11)N;N;N;N;TAB(139)V;TAB(59)V;GOTO4898
518 LPRINTTAB(10)D;TAB(11)N;N;N;N;TAB(139)V;TAB(59)V;GOTO4898
518 LPRINTTAB(10)D;TAB(11)N;N;N;N;TAB(139)V;TAB(59)V;GOTO4898
518 LPRINTTAB(10)D;TAB(11)N;N;TAB(13)V;TAB(59)V;GOTO4898
518 LPRINTTAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB(10)D;TAB
  900
346
350
                                                                                                                                                                                                                                                                                                                                                                                                                                                            Figure 2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                               :(C)
                                                                                                                                                                                                                                                                                                                                                                                                  •••
                                                                                                                                                                                                                                                                                                                                                                                                                                                                              : (G)
     1836 1FS-1THENO1-9:02-1:03-2:04-3:GOTO1886

1848 1FS-2THENO1-9:02-1:03-2:04-9:GOTO1886

1856 1FS-3THENO1-6:02-7:03-8:04-9:GOTO1886

1868 1FS-4THENO1-9:02-18:03-11:04-12:GOTO1886
      1878 01=12:102=13:103=14:04=15
1888 E${1}=x${($+01,B1)}:E${2}=x${($+01,B2)}:E${3}=x${($+02,B1)}:E${4}
=x${($+02,B2)}:E${5}=x${($+03,B1)}:E${6}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${($+04,B2)}:E${7}=x${
      1691 NEXT X
1695 D1=E$(1):D2=E$(2):D3=E$(3):D4=E$(4):D5=E$(5):D6=E$(6):D7=E$
                                                                                                                                                                                                                                                                                                                                                                                                                                                                             :(0)
    1895 D1=85(1);D2=85(2);D3=85(3);D4=85(4);D3=85(5);D0=85(6);

2898 U1=1;U2=1;U3=1;U4=1;U5=1;U6=1;U7=1;U8=1;RETURN

3898 OPEN*I*,1,"EAGLE/DAT*;INPUT*01;DATE$

3818 PORX=1T028:FORX1=1T028:INPUT*01,Z$(X,X1);NEXTX1:NEXTX

3828 CLOSE;RETURN

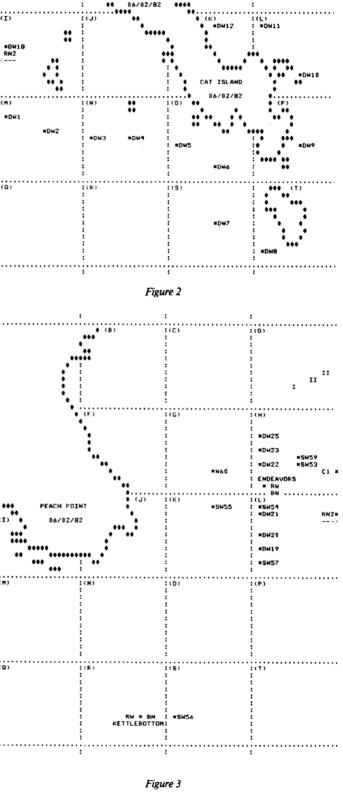
3858 CLOSE;EMD

4868 LPRINTSTRING$(3,138);RUN*MARBLE*
```

#### Program Listing 4

```
CLEAR 3288:CLS:PRINT@465, "WORKING FILENAME...."; CHR$(34); "MARB
LE*;CBR $(34)
4 ON ERROR GOTO 3858
5 DEFSTR V,H,M,D:M="$":V=":":H=".":DEFINTU,B,O,X:DIMZ$(28,28):GO
 LPRINTTAB(19) V; TAB(39) V; TAB(59) V; LPRINTSTRING$(80, H)
```

Listing 4 continues



≖C5

**≭D**₩24

×0₩13

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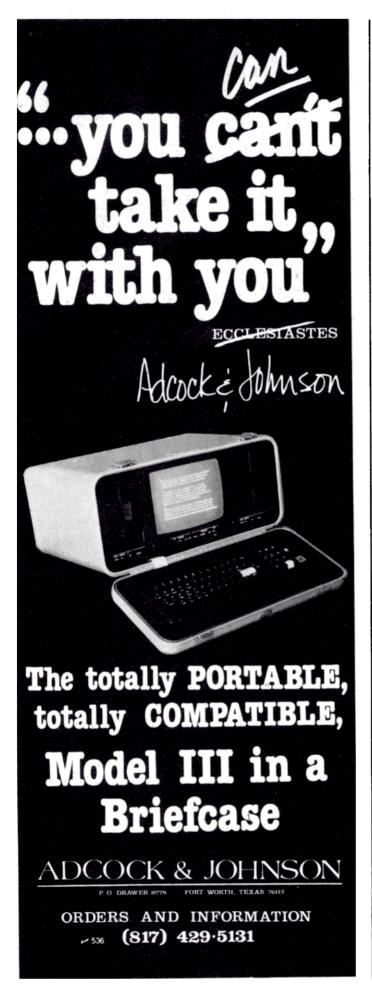


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**-** 120



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```
18 LPRINT"(A)"; TAB(15)"* C1"; V; "(B)"; TAB(39)V; "(C)"; TAB(59)V; "(D)"; COSUB2886; S=1; L=1; U2=8; GOSUB1888
28 LPRINT" "D1; TAB(12)" II"; TAB(19)V; ""D3; TAB(38)D4; TAB(39)V; ""D5; TAB(58)D6; TAB(58)V; ""D7; STRING$(78-PEEK(16539); 32); D8; GOSUB1
  30 LPRINT
                                  INT" "D1;TAB(11)" I I I";TAB(19)V;" "D3;TAB(38)D4;TAB(39)V;
TAB(58)D6;TAB(59)V;" "D7;STRING$(78-PEEK(16539),32);D8:GOS
  UBL000
48 LPRINT" "D1;TAB(10)"I I I";TAB(19)V;" "D3;TAB(30)D4;TAB(39)
V;" "D5;TAB(50)D6;TAB(59)V;" "D7;STRING$(78-PEEK(16539),32);D8:G
OSUB1000
  OSUB1886
58 LPRINT" "D1;TAB(14) "I";TAB(19) V; "D3;TAB(38) D4;TAB(39) V; "D
5;TAB(58) D6;TAB(59) V; "D7;STRING$(78-PEEK(16539),32);D8:GOSUB18
  96
68 LPRINT" "D1;TAB(15)"1";TAB(19)V;" "D3;TAB(38)D4;TAB(39)V;" "D
5;TAB(58)D6;TAB(59)V;" "D7;STRING$(78-PEEK(16539);32);D8:GOSUB16
  78 LPRINT" "D1;TAB(16)"1";TAB(19);V;" "D3;TAB(38)D4;TAB(39)V;" "D5;TAB(58)D6;TAB(59)V;" "D7;STRING$(78-PEEK(16539),32);D8:GOSUB1
156 LPRINT" "D1; TAB(9) D2; TAB(19) V; "D3; TAB(36) D4; TAB(39) V; "D5; TAB(56) D6; TAB(59) V; "D7; STRING$(78-PEEK(16539), 32); D8: GOSUB188
   166 LPRINT" "D1;TAB(9)D2;TAB(19)V;" "D3;TAB(30)D4;TAB(37)M;M;M;" "D5;TAB(50)D6;TAB(59)V;" "D7;STRING$(70-PEEK(16539),32);D8:U4-0:U5-0:GOSUB1800
                                                    T" "D1;TAB(9)D2;TAB(19)V;" "D3;TAB(36)M;TAB(46)M;TAB(46"
" "D6;TAB(59)V;" "D7;STRING$(70-PEEK(16539),32);D8;GOSU
    174 LPRINTS
   ) M; N; N; N; N; B1000
 | Nation | N
   ) " "07; STRINGS (78-PEEK (16539),32); D8: GOSUB2888: U4-8: U5-8: U6-8: GOSUB1888
278 LPRINT" "D1: TAB(9) D2: TAB(19) V; "D3: TAB(33) M; TAB(68) M; TAB(63)
) " ",D7; STRINGS (78-PEEK (16539),32); D8: U4-8: GOSUB1888
288 LPRINT" "D1; TAB(9) D2: TAB(19) V; "D3: TAB(29) D4; TAB(34) M; TAB(61) M; TAB(63) "D7; STRINGS (78-PEEK (16539),32); D8: GOSUB1888
298 LPRINT" "D1; TAB(9) D2: TAB(19) V; "D3; TAB(29) D4; TAB(34) M; TAB(62) M; TAB(63) "D7; STRINGS (78-PEEK (16539),32); D8: GOSUB1888
388 LPRINT" "D1; TAB(9) D2; TAB(19) V; "D3; TAB(29) D4; TAB(34) M; TAB(62) M; TAB(63) "D7; STRINGS (78-PEEK (16539),32); D8: U3-8: U4-8: GOSUB1888
2) M; TAB(63) "D7; STRINGS (78-PEEK (16539),32); D8: U3-8: U4-8: GOSUB1888
     316 LPRINT" "D1; TAB(9)D2; TAB(17) N; N; N; TAB(35) N; TAB(62) N; "D7; ST
RING$(76-PEEK(16539); 32); D8:GOSUB2888: U3-8: U4-8: U5-8: U6-8:GOSUB1
      000
320 LPRINT
      328 LPRINT" "D1;TAB(9)D2;TAB(16)N;TAB(28)N;N;N;N;TAB(29)N;N;N;N;
TAB(35)N;TAB(61)N;TAB(63)" "D7;STRINGS(78-PEEK(16539);32);D8:GOS
     339 LPRINT" "D1;TAB(9)D2;TAB(17)M;TAB(24)M;M;M;M;M;M;TAB(33)M;M;TAB(56)M;M;M;TAB(61)M;TAB(63)" "D7;STRING$(78-PEEK(16539),32);D8;G
     OSUB1888
348 LPRINT" "D1;TAB(9)D2;TAB(17)M;TAB(41)M;M;TAB(55)M;TAB(59)M;M
;TAB(63)" "D7;STRING$(78-PEEK(16539),32);D8;GOSUB1888
358 LPRINT" "D1;TAB(9)D2;TAB(16)M;TAB(40)M;TAB(43)M;M;TAB(53)M;M
;TAB(59)V;TAB(63)" "D7;STRING$(78-PEEK(16539),32);D8
368 LPRINTSTRING$(16,8);M;TAB(48)M;H;H;H;H;M;TAB(51)M;M;STRING$(
    27,B) 18=41L-1
376 LPRINT"(N) ",TAB(17) M,TAB(48) M,"(0) ",TAB(46) M,TAB(59) M,TAB(59)
V,"(2) ",GOSUB1898
388 LPRINT" "D1;TAB(9) D2;TAB(18) M,TAB(38) M,M,TAB(47) M,M,M,TAB(59)
V," "D7;STRINGS(78-PEEK(16539),32);D8:U6-1:GOSUB1898
398 LPRINT" "D1;TAB(9) D2;TAB(19) M,M;TAB(37) M,TAB(37) V," ",H,M,TAB(59) D6;TAB(59) V," "D7;STRINGS(78-PEEK(16539),32);D8:GOSUB1898
489 LPRINT" "D1;TAB(9) D2;TAB(19) V,TAB(21) M,M,TAB(36) M,TAB(39) V,M,TAB(33) M,TAB(39) V,M,TAB(33) M,TAB(39) V,M,TAB(39) V,
     :GOSUB1686
418 LPRINT" "D1;TAB(9)D2;TAB(19)V;TAB(23)N;N;TAB(35)N;TAB(39)V;"
";N;N;TAB(58)D6;TAB(59)V;" "D7;STRING$(76-PEEK(16539),32);D8:GO
    SUB1866
428 LPRINT" "D1;TAB(9)D2;TAB(19)V;"(N)";TAB(25)M;M;M;TAB(34)M;TA
B(39)V;TAB(58)D6;TAB(59)V;" "D7;STRING$(78-PEEK(16539),32);D8:U3
-1:GOSUB180**
01;TAB(9)D2;TAB(19)V;" "D3;TAB(28)M;TAB(33)M;TAB(39)V;" "D5;TAB(58)D6;TAB(59)V;" "D7;STRING$(78-PEEK(16539),32);D8:
    GOSUB1888
448 LPRIMT" "D1;TAB(9)D2;TAB(19)V; "D3;TAB(29)M;M;M;M;TAB(39)V;
"D5;TAB(58)D6;TAB(59)V; "D7;STRING$(78-PEEK(16539),32);D8:GOS
UB2688:U4-8:GOSUB1888
458 LPRIMT" "D1;TAB(9)D2;TAB(19)V; "D3;TAB(39)V; "D5;TAB(58)D6
;TAB(59)V; "D7;STRING$(78-PEEK(16539),32);D8:GOSUB1888
468 LPRIMT" "D1;TAB(9)D2;TAB(19)V; "D3;TAB(38)V; "D5
;TAB(58)D6;TAB(59)V; "D7;STRING$(78-PEEK(16539),32);D8:GOSUB1888
        476 LPRINT" "D1;TAB(9)D2;TAB(19)V;" "D3;TAB(38)D4;TAB(39)V;" "D5;TAB(58)D6;TAB(59)V;" "D7;STRING$(78-PEEK(16539),32);D8
488 LPRINTSTRING$(88,H):S=5:L=1
```

Listing 4 continues

Listing 4 continued

```
### Listing 4 continued

498 LPRINT"(0) ", TAB(19) V, "(R) ", TAB(39) V, "(S) ", TAB(59) V, "(T) ":GOS
UB1088
588 FORC-1TO18:LPRINT" "D1; TAB(9) D2; TAB(19) V; "D3; TAB(38) D4; TAB
(39) V, "D5; TAB(58) D6; TAB(59) V, "D7; STRING$(78-PEEK(16539), 32);
D8:GOSUB1868:NEXTC
518 LPRINTSTRING$(88, H)
528 LPRINTTAB(19) V, TAB(39) V, TAB(59) V
538 GOTO 4888
1868 REM ASSIGN D1>D8 HERE
1816: IPL-1THEN81=1:B2-28ELSEIFL=2THENB1=2:B2-19ELSEIFL=3THENB1=3:B2-18ELSEIFL=4THENB1=1:B2-28ELSEIFL=5THENB1=5:B2-16
1826: IPL-6THENB1=4:B2-17ELSEIFL=5THENB1=7:B2-14ELSEIFL=8THENB1=8:B2-13ELSEIFL=9THENB1=9:B2-12ELSEIFL=18THENB1=18:B2-11
1838 IFS-1THENG1=5:B2-15ELSEIFL=1THENB1=7:B2-14ELSEIFL=8THENB1=8:B2-13ELSEIFL=9THENB1=5:B2-12
1839 IFS-3THENG1=5:C2-1:C3-2:C4-3:GOTO1888
1848 IFS-3THENG1=3:C2-1:C3-2:C4-3:GOTO1888
1859 IFS-3THENG1=5:C2-1:C3-2:C4-3:GOTO1888
1868 IFS-4THENG1=9:C2-1:B3-12:C4-12:GOTO1888
1878 O1=12:O2-13:O3-14:O4-15
1888 E(1)=X5(8+O1,B1):E5(2)=X5(8+O1,B2):E5(3)=X5(8+O2,B1):E5(4)
=IS(8+O2,B2):ES(5)=Z5(8+O3,B1):ES(6)=Z5(8+O3,B2):ES(7)=IS(8+O4,B2)
1882 FOR X=1 TO 8:IFFS(X)="THEN1891ELSETS=RIGHTS(ES(X), LEN(ES(X))-2):GOTO1898
1898 TS=RIGHTS(ES(X), LEN(ES(X))-3)
1898 CS=LEFTS(TS,1):IPCS="S"ORCS="D"ORCS="W"THENES(X)="*"+T5:GOTO1891ELSEGOTO1888
1891 NEXT X
1895 D1=ES(1):D2=ES(2):D3=ES(3):D4=ES(4):D5=ES(5):D6=ES(6):D7=ES(7):D8=ES(8):D8=ES(8):D4=ES(8):D4=ES(8):D5=ES(5):D6=ES(6):D7=ES(7):D8=ES(8):D8=ES(8):D4=ES(8):D4=ES(8):D5=ES(5):D6=ES(6):D7=ES(7):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES(8):D8=ES
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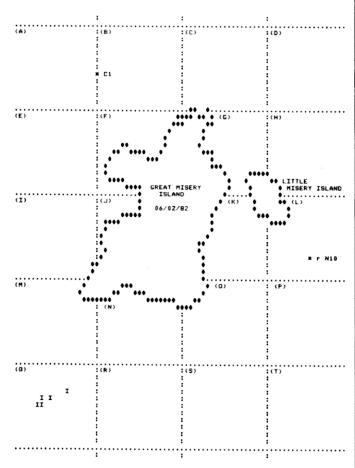


Figure 4

#### Program Listing 5

Listing 5 continues

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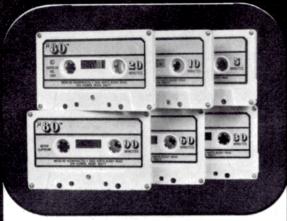
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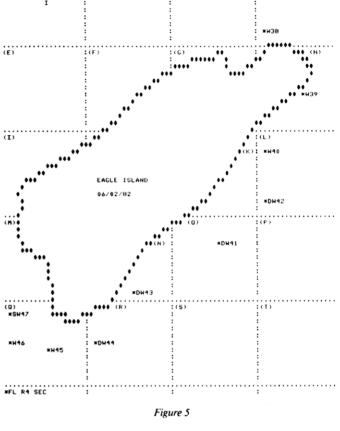
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```
Listing 5 continued
       GOSUB5:GOSUB1000
29 GOSUB5:GOSUB1000
30 GOSUB5:GOSUB1000
40 GOSUB5:GOSUB1000
50 GOSUB5;U3=8;GOSUB1800
60 LPRINT" "D1;TAB(10)D2;TAB(19)"* C1";TAB(30)D4;TAB(39)V; "D5;
TAB(50)D6;TAB(59)V; "D7;STRING$(70-PEEK(16539),32);D8:U3=1:GOSU
B1000
 70 GOSUB5:GOSUB1000
 88 GOSUB5:GOSUB1000
90 GOSUB5:GOSUB1000
 100 GOSUB5
 100 GOSUB5
110 LPRINTSTRING$(41,H);M;M; ",M;STRING$(34,H):U5=0:S=2:L=1
120 LPRINT*(E)";TAB(19)V;"(P)";TAB(38)M;M;M;M;" ";M;M;" ",M;M;" ",M;" (G
)";TAB(59)V;"(E)";GOSUB1000
130 GOSUB3000:LPRINT* "D3;TAB(30)D4;TAB(37)M;M;TAB(45)M;M;TAB(50)D6;TAB(59)V;" "D7;STRING$(70-PEEK(16539),32);D8:U4=0:U5=0:GOS
 148 GOSUB3868:LPRINT" "D3; TAB(36) M; TAB(44) M; TAB(58) D6; TAB(59) V; "
148 GOSUB3800;LPRINT" "D3;TAB(36)N;TAB(44)N;TAB(59)D5;TAB(59)V;"
"D7;STRING$(70-PEEK(16539),32);D8:GOSUB1808
158 GOSUB3800;LPRINT" "D3;TAB(35)N;TAB(44)N;TAB(58)D6;TAB(59)V;"
"D7;STRING$(70-PEEK(16539),32);D8:U3-06;GOSUB1808
169 GOSUB3800;LPRINTTAB(25)N;M;TAB(35)N;TAB(43)N;TAB(58)D6;TAB(59)V;"
"D7;STRING$(70-PEEK(16539),32);D8:GOSUB1800
178 GOSUB38000;LPRINTTAB(23)N;N;"
"N;N;N;N;"
"N;TAB(44)N;N;"
"TAB(58)D6;TAB(59)V;" "D7;STRING$(70-PEEK(16539),32);D8:GOSUB1800
 8
188 GOSUB3888:LPRINTTAB(22) M; TAB(31) M; M; TAB(46) M; TAB(58) D6; TAB
(59) Y; ""D7; STRINGS(78-PEEK(16539), 32); DB:U5-8:GOSUB1888
198 GOSUB3888:LPRINTTAB(21) M; TAB(64) M; M; TAB(59) Y; ""D7; STRINGS
(78-PEEK(16539), 32); DB:U7-8:GOSUB1888
288 GOSUB3888:LPRINTTAB(21) M; TAB(49) M; TAB(55) M; M; M; M; M; STRINGS(78-PEEK(16539), 22); DB:U8-8:GOSUB1888
Listing 5 continues
```

```
J=# GUSUB3866:LPRINT" (N) ";TAB(38)N;N;N;N;TAB(58)D6;TAB(59)V;"
D7;STRING$(78-PER(16539),32);D8:GOSUB2866:GOSUB1688
486 GOSUB5:GOSUB1886
418 GOSUB5:GOSUB1888
428 GOSUB3:GOSUB1888
  438 GOSUB5:GOSUB1888
448 GOSUB5:GOSUB1888
458 GOSUB5:GOSUB1888
  466 GOSUB5: GOSUB1688
          LPRINTSTRING$(88,E);S-5;L-1
LPRINT*(Q)*,TAB(19)V;*(R)*,TAB(39)V;*(S)*,TAB(59)V;*(T)*;GOS
  UB1000
  A98 COSTIRS - COSTIR 1 464
  498 GOSUB5:GOSUB1898
598 GOSUB5:GI-8:U2-8:GOSUB1898
518 LPRINTTAB(12)A;TAB(19)V; "D3;TAB(38)D4;TAB(39)V;" "D5;TAB(5
8)D6;TAB(59)V;" "D7;STRING$(78-PEEK(16539),32);D8:GOSUB1898
528 LPRINTTAB(6)A; "A;TAB(19)V;" "D3;TAB(38)D4;TAB(39)V;" "D5;T
AB(58)D6;TAB(59)V; "D7;STRING$(78-PEEK(16539),32);D8:GOSUB1898
538 LPRINTTAB(5)A;TAB(19)V; "D3;TAB(38)D4;TAB(39)V; "D5;TAB(58)D6;TAB(59)V;" "D7;STRING$(78-PEEK(16539),32);D8:GOSUB2898:GOS
```

```
UB1000
540 GOSUB5:GOSUB1000
550 GOSUB5:GOSUB1000
560 GOSUB5:GOSUB1000
568 GOSUB5:GOSUB1988
578 GOSUB5:GOSUB1988
588 GOSUB5:GOSUB1988
598 LPRINTSTRINGS(88:8):GOSUB7:GOTO4898
1898 REM ASSIGN D1D-08 HERE
1810 IFL=1THENB1=1:82=28ELSEIFL=2THENB1=2:82=19ELSEIFL=3THENB1=3:82=18ELSEIFL=4THENB1=4:82=17ELSEIFL=5THENB1=3:82=18ELSEIFL=6THENB1=6:82=17ELSEIFL=5THENB1=7:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEIFL=6THENB1=8:82=17ELSEI
:B2-13ELSEIFL-9THENB1-9:B2-12ELSEIFL-16THENB1-16:B2-11
1836 IFS-1THEND1-8:O2-1:O3-2:O4-3:GOTO1886
1848 IFS-2THEND1-3:O2-4:O3-5:O4-6:GOTO1886
1858 IFS-3THEND1-6:O2-7:O3-8:O4-9:GOTO1886
1858 IFS-3THEND1-9:O2-10:O3-11:O4-12:GOTO1886
1878 O1-12:O2-13:O3-14:O4-15
1888 E5(1)-25(S+O1,B1):E5(2)-25(S+O1,B2):E5(3)-25(S+O2,B1):E5(4)
15(S+O2,B2):E5(5)-25(S+O3,B1):E5(6)-25(S+O3,B2):E5(7)-25(S+O4,B1)
1):E5(8)-25(S+O4,B2)
 1895 D1=E$(1):DZ=E$(2):D3=E$(3):D4=E$(4):D5=E$(5):D6=E$(6)(7):D8=E$(8):LD-I:RETURN
2898 U1=1:U2=1:U3=1:U4=1:U5=1:U6=1:U7=1:U8=1:RETURN
3898 LPRINTTAB(1)D1;TAB(18)D2;TAB(18)V1;RETURN
3598 OPEN*1*,1,*MISERY/DAT*:INPUT*01,DATE$
3518 PORX=1T028:FORX1=1T028:INPUT*01,E$(X,X1):MEXTX1:MEXTX
3528 CLOSE:RETURN
3558 CLOSE:END
       4000 LPRINTSTRING$(3,138):RUN*PEACH*
```

#### Program Listing 6

B(59)V;:RETURN
3 LPRINTTAB(30)D4;TAB(39)V; "D5;TAB(50)D6;TAB(59)V;" "D7;STRING \$\frac{\( (78-PEEK(16539),32\) \| 108:RETURN \\
4 LPRINTTAB(39)\( V; \) "D5;TAB(59)\( D6;TAB(59)\( V; \) "D7;STRING\$\( (78-PEEK(16539),32\) \| 108:RETURN \\
5 LPRINTTAB(1)\( D1);TAB(19)\( D2;TAB(19)\( V; \) "D3;TAB(39)\( D4;TAB(39)\( V; \) " D5;TAB(58)D6;TAB(59)V; "D7;STRING\$(78-PEEK(16539),32);D8:RETURN
7 LPRINTTAB(19)V;TAB(39)V;TAB(59)V;RETURN
8 GOSUB7:LPRINTSTRING\$(88,H):GOSUB2888
18 LPRINTTAB(23)H," (B) ",TAB(39);V;"(C) ",TAB(59)V;"(D) ";U1-8:U2-8:S-1;L-1:GOSUB1888 8:5-11L-1:GOSUB1899
26 LPRINTTAB(29) N, N; M; "D3;:GOSUB3;GOSUB1899
38 LPRINTTAB(19) N, TAB(23) D3;:GOSUB3;GOSUB1899
48 LPRINTTAB(29) N, N; TAB(23) D3;:GOSUB3;GOSUB1899
59 LPRINTTAB(17) N, N; M; N, N; TAB(23) D3;:GOSUB3;GOSUB3;GOSUB1899 LPRINTTAB(16) H, TAB(19) V, TAB(23) D3; :GOSUB3:U7=8:U8=6:GOSUB1966 Listing 6 continues

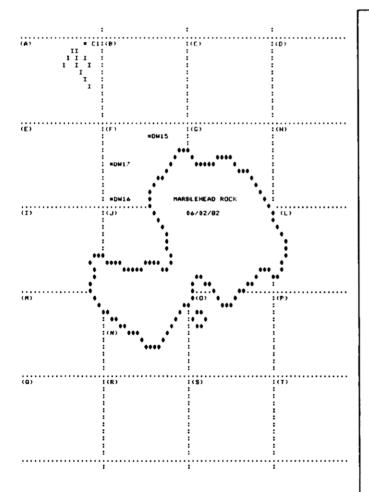


Figure 6



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```
70 LPRINTTAB(15) M;:GOSUB2:LPRINTSTRING$(76-PEEK(16539),32);A;A;G
     80 LPRINTTAB(15)M::GOSUB2:LPRINTSTRINGS(73-PEEK(16539),32);A:A:G
                      LPRINTTAB(15) M;:GOSUB2:LPRINTSTRING$(69-PEEK(16539),32);A:U9=
      1:U8=1:GOSUB1000
 1100=11GOSUB1898
188 LPRINTTAB(15) M; TAB(19); V; TAB(23) D3; IGOSUB3; GOSUB1898
118 LPRINTTAB(15) M; TAB(19) V; TAB(23) D3; IGOSUB3
128 LPRINTTAB(17) M; * ", STRINGS(68, H) IS=21L=1
138 LPRINTTAB(18) M; * ", " (F) ", TAB(39) V; "(G) ", TAB(59) V; "(H) ":GOSUB
128 LPRINTTAB(17) M; ",5TRINGS(68,B);S=2;L=1
138 LPRINTTAB(18) M; ","(")",TAB(39) V;"(G)",TAB(59) V;"(H)":GOSUB
2898;UJ=6;UZ=6;GOSUB1898
148 LPRINTTAB(19) M;TAB(23) D3;:GOSUB3:GOSUB1898
158 LPRINTTAB(28) M;TAB(23) D3;:GOSUB3:GOSUB1898
169 LPRINTTAB(21) M;TAB(23) D3;:GOSUB3:GOSUB1898
179 LPRINTTAB(21) M;TAB(23) D3;:GOSUB3:GOSUB1898
189 LPRINTTAB(21) M;TAB(23) D3;:GOSUB3:U3=8:GOSUB1898
189 LPRINTTAB(21) M;M;;GOSUB3:U3=8:GOSUB1898
189 LPRINTTAB(24) M;M;;GOSUB3:GOSUB1898
180 LPRINTTAB(24) M;M;GOSUB3:U3=8:GOSUB1898
181 LPRINTTAB(24) M;M;GOSUB3:U3=8:GOSUB1898
182 LPRINTTAB(24) M;M;M;TAB(39) V; "D5;TAB(58) D6;TAB(59) V; "D7;STRINGS(76-PEEK(16539),32);"C1 "":U7=8:GOSUB1898
182 LPRINTTAB(27) M;M; "D4;TAB(39) V; "D5;TAB(58) D6;TAB(59) V; "ENDEAVORS":U4-8:GOSUB1898
183 LPRINTTAB(29) M;M;TAB(39) V; "D5;TAB(58) D6;TAB(59) V;TAB(62) "*RM*:GOSUB1898
184 LPRINTTAB(38) M;STRINGS(32,H);"BN ";STRINGS(13,H):S=3:L=1
185 LPRINTTAB(38) M; STRINGS(32,H);"BN ";STRINGS(13,H):S=3:L=1
185 LPRINTTAB(38) M; STRINGS(32,H);"BN ";STRINGS(13,H):S=3:L=1
186 LPRINTTAB(38) M; STRINGS(32,H);"BN ";STRINGS(33,H):SGSUB298
186 LPRINTTAB(38) M; STRINGS(32,H);"BN ";STRINGS(30,H);GOSUB298
186 LPRINTTAB(38) M; STRINGS(32,H);"BN ";TAB(59) V; "L) ";GOSUB298
186 LPRINTTAB(38) M; STRINGS(32,H);"BN ";STRINGS(33,H);GOSUB4:U8=8
186 LPRINTTAB(38) M;M;TAB(18) "PEACH POINT";TAB(38) M;:GOSUB4:U8=8
186 LPRINTTAB(18) M;M;TAB(18) "PEACH POINT";TAB(38) M;:GOSUB4:U8=8
186 LPRINTTAB(38) M;M;TAB(18) "PEACH POINT";TAB(38) M;:GOSUB4:U8=8
186 LPRINTTAB(38) M;M;TAB(18) "PEACH POINT";TAB(38) M;:GOSUB4:U8=8
186 LPRINTTAB(38) M;TAB(38) M;TAB(38) M;;GOSUB4:U8=8
186 LPRINTTAB(38) M;TAB(38) M;TAB(38) M;;GOSUB4:U8=8
186 LPRINTTAB(38) M;TAB(38) M;TAB(38) M;;GOSUB4:U8=8
186 LPRINTTAB(38) M;TAB(38) M;TA
 UBL000
296 LPRINTTAB(6) M; TAB(27) M; M; M; M; " "; M; :GOSUB4: GOSUB1000
306 LPRINTTAB(3) M; M, M; TAB(26) M; TAB(30) M; M; :GOSUB4: U4=1: GOSUB1000
310 LPRINTTAB(3) M; M; M; M; TAB(25) M; :GOSUB3: GOSUB1000
320 LPRINTTAB(7) M; M; M; M; TAB(25) M; :GOSUB3: GOSUB1000
330 LPRINTTAB(7) M; M; M; M; TAB(25) M; :GOSUB3: GOSUB1000
330 LPRINTTAB(4) M; M; TAB(12); STRING$(10, M); " "; M; :GOSUB3: GOSUB10000
  346 LPRINTTAB(8)M;M;H;TAB(19)V;TAB(22)M;M;:GOSUB3:GOSUB1888
356 LPRINTTAB(12)M;M;H;TAB(19)V;:GOSUB3
366 LPRINTSTRINGS(88,B):GOSUB2888;S=4;L=1
376 LPRINT*(H)*;TAB(19)V;*(N)*;TAB(39)V;*(O)*;TAB(59)V;*(P)*:GOS
  UBLUSUS
588 FORC=1T05:GOSUB5:GOSUB1898:NEXTC:GOSUB5:U4-8:GOSUB1888
568 LPRINT" "D1;TAB(18)D2;TAB(19)V;" "D3;TAB(39) "RN " BN";TAB(39)
)V;" "D5;TAB(58)D6;TAB(59)V;" "D7;STRINGS(78-PEEK(16539),32);D8:
     COSUR 1 844
   578 LPRINTTAB(1)D1;TAB(18)D2;TAB(19)V;" "D3;TAB(27) "KETTLEBOTTOM";V;" "D5;TAB(58)D6;TAB(59)V;" "D7;STRING$(78-PEEK(16539),32);D8
      :GOSUB2000:GOSUB1000
     580 GOSUB5:GOSUB1800
590 GOSUB5:LPRINTSTRING$(80,H):GOSUB7:GOTO4000
 598 GSUB5:LPRINTSTRING$(88,H):GOSUB7:GOTO4888
1888 REM ASSIGN DI>DB HERE
1818 IFL-ITHENB1-1:B2-26LSEIFL-2THENB1-2:B2-19ELSEIFL-3THENB1-3:B2-18ELSEIFL-4THENB1-1:B2-26LSEIFL-2THENB1-5:B2-16
1828 IFL-6THENB1-6:B2-15ELSEIFL-1THENB1-7:B2-14ELSEIFL-8THENB1-8:B2-13ELSEIFL-9THENB1-9:B2-12ELSEIFL-10THENB1-18:B2-11
1838 IFS-1THENO1-8:O2-1:O3-2:O4-3:GOTO1888
1858 IFS-3THENO1-8:O2-4:O3-5:O4-6:GOTO1888
1858 IFS-3THENO1-6:O2-7:O3-8:O4-9:GOTO1888
1858 IFS-3THENO1-6:O2-7:O3-8:O4-9:GOTO1888
1859 O1-12:O2-13:O3-14:O4-15
1868 IFS(1)-25(S+O4,B1):E5(2)-25(S+O4,B2):E5(3)-25(S+O2,B1):E5(4)
-25(S+O2,B2):E5(5)-25(S+O3,B1):E5(6)-25(S+O3,B2):E5(7)-25(S+O4,B1):E5(8)-25(S+O4,B2):E5(7)-25(S+O4,B1):E5(8)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E5(7)-25(S+O4,B2):E
   :GOTO1891ELSEGOTO1888
1891 NEXT X
1895 D1=E$(1):D2=E$(2):D3=E$(3):D4=E$(4):D5=E$(5):D6=E$(6):D7=E$
(7):D8=E$(8):L=L+1:RETURN
2888 U1=1:U2=1:U3=1:U4=1:U5=1:U6=1:U7=1:U8=1:RETURN
3888 OPEN*I*,1,*PEACH/DAT*:INPUT*1,DATE$
3818 FORX=1T028:FORX1=1T028:INPUT*1,Z$(X,X1):NEXTX1:NEXTX
3828 CLOSE:RETURN
3858 CLOSE:EMD
4888 LPRINTSTRING$(3,138):RUN*DAT/COL*
```

#### Program Listing 7

```
188 REM .....
118 ON ERROR GOTO 378
128 CLEAR 5888:DIMIS(28,28),D$(28,28):CLS:U=1:V=448:GOSUB398
138 GOSUB478:PRINT89,"":INPUT"ENTER MAP NAME",MAPS:IF MAP$="CAT"
ORMAP$="EAGLE"ORMAP$="BAKERS"ORMAP$="MARBLE"ORMAP$="MISERY"ORMAP
$="PEACH"THEN148ELSPRINT88,STRING$(63,"):GOTO138
148 GOSUB478:PRINT8192,"READ DATA DISK ? (Y OR N)":GOSUB588:IFS$
="Y"THENGOSUB438
158 GOSUB478:PRINT8192."":INPUT"ENTER DATE OR (ENTER) MM/DD/YY"
 -"Y"THENGOSUB430
150 GOSUB470:PRINT0192,"";:INPUT"ENTER DATE OR (ENTER) MM/DD/YY"
;A$:IFA$<>""THENDATE$-A$:GOSUB310ELSEGOSUB310
160 GOSUB470:PRINT0192,"ERASE KEEPER0 ?? (Y OR N)":GOSUB500:IFS$
-""THEN468ELSEIFS="""THENT10ELSEI60
170 CLS:PRINT00,"DATA INPUT ROUTINE FOR MAP DESIG. ";CHR$(34);MA
 P$
CHR$(34);TAB(53);DATES:PRINTSTRING$(63,"=")
188 GOSUB478:PRINT$192,"ENTER SECTOR OR COMMAND LETTER":GOSUB568
:IF S$="" THEN188ELSELFASC(S$)=>65ANDASC(S$)<-84 AND LEN(S$)=1
HEN198 ELSELFSS=""#THEN138ELSPRINT$192,STRING$(63,""):GOTO188
198 U=1:FORX=1TO28:PO=X:IFZ$(ASC(S$)-64,X)=""THEN268ELSEGOSUB468
```

```
Listing 7 continued
IPU-@THENU-leLSEU-@
                        GOSUB380: GOSUB400
  288 GOSUB-388 GOSUB-488
298 IFU-9THENN-1ELSEU-8
388 PO-8:PC$-":[GOSUB-328:GOTO-228
318 PRINT6]-92,STRING$(63,""):RETURN
328 PRINT6]-28,STRING$(64,""):RETURN
338 MAP$-MAP$+"/DAT":OPEN"O",Z,MAP$:PRINT62,DATE$
348 FORX-1TO-28:FORX-1TO-26:PRINT62,T$(X,X1):NEXTX1:NEXTX
358 FORX-1TO-28:FORX-1TO-26:PRINT62,D$(X,X1):NEXTX1:NEXTX
    398 CLOSE:RESTORE:OUT254,1:V=448:GOSUB428:GOT0128
388 IS(ASC(S$)-64,PO)=S$*RIGBT$(STR$(PO),LEN(STR$(PO))-1)+PC$:D$
(ASC(S$)-64,PO)=K$:RETURN
398 OUT254,8:PORX=1T028:FORX1=1T028:Z$(X,X1)="":NEXTX1:NEXTX:RES
    TORE:OUT254,1:RETURN
488 :FU-lTHEN PRINTEY, Z$(ASC(S$)-64,PO);TAB(9); "S/K=",D$(ASC(S$)-64,PO);TAB(41); "S/K=",D$(ASC(S$)-64,PO);"TAB(41); "S/K=",D$(ASC(S$)-64,PO);"TAB(41); "S/K=",D$(ASC(S$)-64,PO);"TAB(41); "S/K=",D$(ASC(S$)-64,PO);"TAB(41); "S/K=",D$(ASC(S$)-64,PO);"TAB(41); "S/K=",D$(ASC(S$)-64,PO);"TAB(41); "S/K=",D$(ASC(S$)-64,PO);"TAB(41); "S/K=",D$(ASC(S$)-64,PO);"TAB(41); "S/K=",D$(ASC(S$)-64,PO);"TAB(41); "S/K=",D$(ASC(S$)-64,PO);"TAB
          : V=V+64: RETURN
       420 PRINTEV,STRING$(63, ");:IFV=960THENV=448:RETURNELSEV=V+64:G
    ETURN 468 FORX=1TO28:FORX1=1TO28:D$(X,X1)="":NEXTX1:NEXTX:GOTO178 478 OUT 255,1:FOR X=1TO188:NEXTX:OUT 255,8:RETURN 588 S$=INKEY$:IFS$=""THEN588ELSERETURN"
```

49 46 47 46 45 41 40 39 31 33 32 31 30 29 27 SSSSSSS sssssss R SSSSSSS KKKKKKK SSSSSSS KKKKKKK CAT MAR PEA \* \* MAP AREA DESIGNATIONS \* \*

\* \* HILLIAMS -- FISH & LOBSTERS \* \*

Figure 7

#### Program Listing 8 100 ON ERROR GOTO 450: REM FILENAME "DAT/COL" 110 CLEAR 5000: DEFINTX, K, C: DIMP\$(6,50), 2\$(20,20), D\$(20,20), E\$(10 128 DATA BAKERS/DAT,CAT/DAT,EAGLE/DAT,MARBLE/DAT,MISERY/DAT,PEAC 136 DATABA, CA, EA, MA, MI, PE 146 REM INPUT THE SIX FILES AND ASSIGN TO P\$ ARRAY Listing 8 continues

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**********			06/02/82
MAP DESIGBAKERS L7DH36=2/1 L9DH35=9/1		/1 M5SH48=0/0	M14SH50=0/0
M15SH49=2/2 N15DH30=7/0			017DW32=3/2
019SW33×5/0 P1DW34×2/3			01/ UN32-3/2
BAKERS TTL'S POTS= 1			
MAP DESIGCAT			
C12DHZ4=5/0 G14DH13=1/1	G20DH14=4/1 I4DH18=2/	0 V200U12=4/2	L10W11=3/0
L13DH10=3/0 H2DH1=1/1	M17DH2=0/0 N5DH3=6/0		
012DH6×2/0 P15DH9×7/0			00000-171
CAT TTL'S POTS- 1	6 SHORTS= 47 KEEPERS		
MAP DESIGEAGLE			
D9M38×0/0 D17DM58×0/0		L9DW42#3/2	N11DH43=0/0
0180H41=4/1 Q1SH47=0/0			
EAGLE TTL'S POTS=:  MAP DESIGMARBLE F5DM17×1/1 F18DM16×3/1	EHEAD		
MARBLEMEAD TTL'S POTS=:  HAP DESIGMISER NO DATA AVAILABLE FOR MISER	· · · · · · · · · · · · · · · · · · ·	= 2 RATIO KPI	RS/POTS 0.7
MISERY TTL'S POTS=			
HAP DESIGPEACH G13M60=0/0 H3DM25=7/1 K20SM55=0/0 L1SM54=0/0 S7SM56=1/0	H5DH23=3/0 H7DH22=2/	0 H14SH53=1/0	H15SW59=1/1
PEACH TTL'S POTS= : TOTALS FOR PERIOD 06/02/82		************	
TOTAL POTS MORKED 60	TOTAL SHORTS 127	TOTAL	KEEPERS 38
% KEEPERS VS. TOTAL 23	SHORTS/POT 2.12	KEEPE	RS/POT 0.63

#### Figure 8

YTD KEEPERS 242

1982 TO DATE TOTALS..... YTD SHORTS 1002

```
Listing 8 Continued

158 FORK-1TO6:CRADTS;CLS:PRINT0448,CHR$(23); "WORKING FILE-NAME "
;T$:GOSUB488:CRADT$;CLS:PRINT0448,CHR$(23); "WORKING FILE-NAME "
;T$:GOSUB488:CRADT$;IFX=1THENB$=DATE$
186 IP DATES:CH$THENGOTO458
187 IP DATES:CH$THENGOTO458
189 FORK1=1TO28:FORK2=1TO28:INPUT01,D$(X1,X2):NEXTX2:NEXTX1
286 FOR X1=1TO28:FORK2=1TO28:INPUT01,D$(X1,X2):NEXTX2:NEXTX1
210 CLOSE
228 PORX1=1TO28:FORX2=1TO28:IFF$(X1,X2)="THEN238ELSE268
228 NEXT X2
228 NEXT X2
258 NEXTX:GOTO278
268 P$(X;C)=25(X1,X2)+"*"+D$(X1,X2):C-C+1:GOTO238
278 RBM ASSIGN FILENAME FROM DATES
288 A$=LEPT$(DATE$, 2):CS-CHD$(DATE$, 4,2)+":1":IFA$="$4"THENB$="A
PR/D*-C$:GOTO378
289 IFA$="85"THENB$="MAY/D*-C$:GOTO378
380 IFA$="86"THENB$="JUN/D*-C$:GOTO378
380 IFA$="86"THENB$="JUN/D*-C$:GOTO378
381 IFA$="86"THENB$="JUN/D*-C$:GOTO378
382 IFA$="86"THENB$="JUN/D*-C$:GOTO378
383 IFA$="86"THENB$="JUN/D*-C$:GOTO378
384 IFA$="11"THENB$="SUN/D*-C$:GOTO378
385 IFA$="86"THENB$="SUN/D*-C$:GOTO378
386 IFA$="86"THENB$="SUN/D*-C$:GOTO378
387 EMB OUTPUT TO DISK
388 CLS:PRINT046$, PPACKING DATA TO DRIVE $1..";B$
389 OPER*-11"THENB$="SUN/D*-C$:GOTO378
389 OPER*-11"THENB$="SUN/D*-C$:GOTO378
389 OPER*-11"THENB$="SUN/D*-C$:GOTO378
389 OPER*-11"THEN 429 ELSE PRINT02,T$+P$(X,X1):X1=X1+1:GOTO4
18
489 KEXT X
439 CLOSE:CLS:GOTO528
448 GOSUB488:PRINT046464,CHR$(23);"JOB COMPLETE":PORJ=1TO588:NEXTJ:PRINT04645;TRING$(12,""):GOTO448
458 KEN ERBO CROUTINE
458 KEN ERBO ROUTINE
458 KEN ERBO ROUTINE
559 CLS:CLS:GOTO528
550 CLS:CLS:GOTO528
550 CLS:CLS:GOTO528
551 CLS:INDUT*ENTE DATA FILE TO READ';B$
552 CLS:INDUT*ENTE DATA FILE TO READ';B$
553 CLS:PRINT0466,"" * READING BACK ";B$;" TO CHECK * *:GOSUB49
554 LIFOP(1)TERB568:'CHECK FOR END OF FILE
555 INPUT04,E$(X):X=X+1:GOTO548:'INPUT COMPRESSED FILE INTO E$(X)
556 CLOSE:FORC-1TO6:FORC1=1TO58:F$(C,C1)="":NEXTC1:NEXTC1:NULL A
LL P$
576 CL:INPUTT4,E$(X):X=X+1:GOTO548:'INPUT COMPRESSED FILE INTO E$(X)
557 CL=1:C2=1:C3=1:C4=1:C5=1:C6=1
558 CLS:FRINT0465;" * STRIPPING STRINGS * ":GOSUB498
559 FORE-1TOX-1:GOSUB81:NEXTK:LOOP $ FROM READ COMPRESSED
```

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Listing 8 continued

688 REM LPRINT ROUTINE
618 CLS:PRINT#468, "\* PRINTING POT INFORMATION \* \*\*:GOSUB498
628 DATA BARERS, CAT, EAGLE, MARBLEHEAD, MISERY, PEACE
638 LPRINT TAB(28) "\* WILLIAMS -- FISH & LOBSTERS \* \*\*;STRINGS
(78-PEEK(16539), 32);DATES
648 LPRINTSTRINGS(88, "\*)
658 FORX-1TO6:READ MAPS:C-8
668 LPRINTTAP DESIG............";MAP\$:IFP\$(X,1) = "THENLPRINT"NO
DATA AVAILABLE FOR ",MAPS:GOTO688: 'CHECK FOR NULL
678 LPRINT TAB(2);P\$(X,1+C);TAB(15);P\$(X,2+C);TAB(28);P\$(X,3+C);
TAB(41);P\$(X,4+C);TAB(54);P\$(X,5+C);STRING\$(67-PEEK(16539),32);P
5(X,6+C)
688 C-C-6:IFC-36THEN998LISE678: 'CHECK FOR SIXTH LINE
698 GOSUB899:LPRINTMAP\$; "TTL'S..",TAB(28);"POTS="K;TAB(31);"SH
ORTS=",SS;TAB(43); KEEPERS=",SK;TAB(57); "RATIO KPRS/POTS..";:22S
="00.0":IF K=0 THEN LPRINTKELSELPRINTUSING225;SK/K:GOSUB398
788 S1(X)=SS:K1(X)=SS:'SS=SECTOR SHORTS SK-SECTOR KEEPERS
718 LPRINTTTOTALS FOR PERIOD ";DATES;".....ALL AREAS........"LPRINT\*
728 LPRINT\*TOTALS FOR PERIOD ";DATES;".....ALL AREAS........"LPRINT\*
739 LPRINT\*TOTAL POTS WORKED";TP;TAB(30);"TOTAL SHORTS";TS;TAB(6);""TOTAL KEEPERS",TK
748 22\$="00.00";LPRINT" ";LPRINT" & KEEPERS VS. TOTAL";INT(1800'(TK/(TK+TS)));TAB(38);"SHORTS/POT...";LPRINTUSING225;TS/TF;LDRINTTAB(65);"REEPERS/POT...";LPRINTUSING225;TS/TF;LDRINTTAB(65);"REEPERS/POT...";LPRINTUSING225;TS/TF;LDRINTTAB(65);"REEPERS/POT...";LPRINTUSING225;TS/TF;LDRINTTAB(65);"REEPERS/POT...";LPRINTUSING225;TS/TF;LDRINT
750 OPEN\*I\*,1,"YEAR/TL";INPUT\*1,YEAR\$:'YS=TOTAL YEAR SHORTS YK
\*\*TOTAL YEAR KEEPERS
768 FORX=1TO6:YS(X)=YS(X)+S1(X):YK(X)=YK(X)+K1(X):NEXTX:'ADD EAC
778 CLOSE
788 FORX=1TO6:YS(X)=YS(X)+S1(X):YK(X)=YK(X)+K1(X):NEXTX:'ADD EAC
778 CLOSE
788 FORX=1TO6:YS(X)=YS(X)+S1(X):YK(X)=YK(X)+R1(X):NEXTX:'ADD EAC
778 LPRINT STRINGS(2,138):GOTO1888
318 REN -

:RETURN 880 IPE\$(K) = END THEN460 890 REM ASSIGN SS-SK 900 IPF\$(X,1) = THENSS-0:SK-0:RETURNELSEIFX-1THENK-C1-1ELSEIFX-2 THENK-C2-1ELSEIFX-3THENK-C3-1ELSEIFX-4THENK-C4-1ELSEIFX-5THENK-C 5-1ELSEIFX=6THENK=C6-1 918 PORK1=1TOK:SK=SK+VAL(RIGHTS(PS(X,K1),1)):TMS=RIGHTS(PS(X,K1) ,3):SS=SS+VAL(LEFT\$(TM\$,1)) 926 NEXTK1: RETURN 930 TP=TP+K:TS=TS+SS:TK=TK+SK:RETURN 948 REM OUTPUT TO DISK YID TOTALS 958 CLS:PRINT@468, \*\* \* UPDATING YID FILES \* \*\*:GOSUB498 960 OPEN"0",2,"YEAR/TTL":PRINT#2,YEAR\$
970 FORX=1T06 988 PRINT#2,YS(X),YK(X):NEXTX: 'YS=YEAR TOTAL SHORTS YK=YEAR TOT AL KEEPERS 998 CLOSE: CLS: GOTO448 998 CLOSE;CLS:GOTO448
1898 REM....START OP GRAPH
1818 LPRINTETRING\$(2,138):V\$=":":H\$=".":A\$=" ":G1\$="SSSSSSS":G2\$
="KKKKKK":G3\$=" "":G4\$="BBBBBBB":G5\$="B B"
1828 LPRINTTAB(21);" "" WILLIAMS -- PFSH 6 LOBSTERS \* \*";STRING\$
(78-PEEK(16539),32);DATE\$:LPRINT" ":LPRINTSTRING\$(88,\*\*"):LPRINT
":L=58 1030 GOSUB1120:LPRINTTAB(2)L; TAB(5); V\$; :GOSUB1180:L=L-1:IFL=39TH 1638 GOSUBLI28:LPRINTTAB(2);L;CD(V,),V, EN1848ELSE1838 1848 READA\$:GOSUBLI20:LPRINTA\$;TAB(2);L;TAB(5);V\$;:GOSUBLI80:L=L -1:IPL=llTHER1858ELSE1848 1858 AS= ":GOSUBLI20:LPRINTTAB(2)L;V\$;:GOSUBLI80:L=L-1:IFL=9THE 1060 GOSUB1120:LPRINTTAB(3)L;TAB(5);V\$;:GOSUB1180:L=L-1:IPL=0THE N1878ELSE1868
1878 LPRINTTAB(6) STRING\$(64,H\$)
1888 LPRINTTAB(11) "BAR", TAB(21), "CAT", TAB(31), "EAG", TAB(41); "MAR
", TAB(51), "MIS", STRING\$(61-PEEK(16538), 32), "PEA", LPRINT" "
1898 LPRINTTAB(25), "" " MAP AREA DESIGNATIONS " "
1898 LPRINTTAB(25), "" " MAP AREA DESIGNATIONS " "
1898 LPRINTSTRING\$(52,138), IGOTO948
1118 DATA\*, \*, A, R, E, A, , T, O, T, A, L, S, \*, \*, \*
1128 FORN-1TO6: REM....ASSIGN A\$(1)>A\$(6)
1138 IFS1(N)-K1(N)ANDS1(N)-LTHENA\$(N)=G\$\$:GOTO1178
1148 IFS1(N)-K1(N)ANDS1(N)>LTHENA\$(N)=G\$\$:GOTO1178
1149 IFS1(N)-LTHENA\$(N)-G\$\$LSEIFK1(N)-LTHENA\$(N)=G2\$:GOTO1178
1168 IF \$1(N)>L OR K1(N)>L THEN A\$(N)=G\$\$ N1 07 0ELSE1 06 0 ";A\$ 1200 RETURN

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fter accumulating the Avarious components of my TRS-80 computer system (a Level II Model I with an expansion interface and 48K of RAM. an MPI disk drive, and an Anderson-Jacobson AJ841 printer) I realized the office desk the components had been accumulating on was becoming less and less accessible. In addition, it was harder and harder to avoid tripping over the rats nest of wiring created by six power cords plugged into various wall outlets. Finally, the computer itself had never been at an ideal height; the desk top was too high for convenient keyboard entry or for viewing the elevated monitor. The system, expanded from the original 16K computer, had clearly outgrown the desk on which it was sitting.

I began looking for an alternative arrangement. My first thought was that the \$200 system desk sold by Radio Shack, while not an insignificant investment, might be worthwhile. However, because Radio Shack designed their system desk with the computer and expansion interface openings on its left side, the desk would not fit in the location I intended to place it. Also, its modern appearance did not fit the decor of the room, it did not eliminate the multiple electrical outlets required to operate the system components, and I did not like placing the disk drive into a cubby hole. The price tag was steep for a desk that failed to be ideal.

On the other hand, the openings in the Radio Shack system desk would eliminate much of the visible wiring and would provide for free air circulation around the computer and expansion interface, both of which are cooled solely by convection.

#### My Own Design

I decided to build my own computer system desk. I created a design I like and which is a part of the system, as well. It provides recesses for the computer and the expansion interface which allow for hidden wiring and adequate convection cooling, and the need for multiple power outlets is eliminated by including a six electrical outlet unit controlled by a single switch. The unit has a single power cord going from the desk to a wall outlet; thus, the entire system is turned on or off with one switch. There is space on the desk for my printer, disk drive, and floppy disk storage, and the desk fits the room decor. Best of all, the desk was simple to build, and the wood cost less than \$30.

I have learned to build things that don't require exacting measurements. Rather than measuring, I mark one piece directly against the piece with which It fits, so the fit is certain and I needn't worry about whether I can measure accurately. Where measurements are absolutely required, I make them as uncritical as possible.

I decided to incorporate the openings of the Radio Shack system desk, but to make the desk in the form of a Parson's table. This leaves room on the left side of the computer for the printer and on the right side for the disk drive and disk storage. The tape recorder can occupy space behind the disk drive. The only important dimensions were the overall size of the desk top and the height of the desk (low enough to type comfortably, high enough to fit my knees under it).

The result is shown in the photograph and described more fully in the plans. While I have included the actual measurements of my desk, you should follow the general principles rather than the specifics to get the desk that

completes your system.

#### **Non-Critical Cuts**

I wanted a top surface of 49 3/4 inches by 281/4 inches. The top is made out of a piece of 5/8 inch particle board, an extremely hard, dense material which comes in 4 foot by 8 foot sheets selling for about \$6 per sheet. To keep things simple while providing a finished edge (apron), I sawed a 261/2 inch piece off one end of a sheet of particle board. The 48 inch by 261/2 inch piece would provide me with the desired top surface after the apron was added. To ensure a straight cut, saw the top from the sheet using a sabre saw guided along a straight board clamped to the sheet by a pair of C-clamps or adjustable wood clamps.

After cutting the desk top from the sheet, make the openings for the computer and the expansion interface. Lay out the openings in the top and follow the lines with a hand-guided sabre saw. Start the cuts by drilling a hole some place within the openings or by using a plunge cut with the sabre saw. A

The Key Box

Model I Expansion Interface Printer plunge cut is made by starting the saw and then tilting it into the waste area of the opening. The openings for the computer and the expansion interface are sized to allow wires to pass through and are not critical, so do not worry if your measurements are off; just try to keep the cuts fairly straight. I rounded the corners by drawing arcs with a quarter. Without a single critical cut or measurement, the top is complete.

I selected poplar for the apron; clear pine could be used and is more widely available, but I prefer to use hardwoods and suggest poplar, walnut, maple, or oak. The width of the apron is not critical, but for best appearance it should be approximately the same as the legs, which are made of square stock. I chose to use stock that was 7/8 inch thick by 2% inches wide, but these dimensions are not critical. 1 by 3 clear pine, which has actual dimensions of 34 inch by about 234 inches, could also be used.

Next the end pieces are cut to length. Since they should be the same length as the ends of the desk top, mark them off directly against the desk top and cut them to length. The front and back apron pieces are cut to equal the lengths of the front and the back of the desk top (which might not be exactly equal) plus twice the thickness of the apron material.

After the apron pieces have been cut to size, the leas are cut to length from square stock. I used 21/2 inch square poplar, but 3 by 3 fir can be used. The length of the legs is equal to the height of the desk top, minus the final thickness of the top. My desk has a top that is 5/8 inch thick and legs that are 251/4 inches long. This provides me with adequate knee clearance under the front apron (231/2 inches), while keeping the keyboard and monitor at comfortable typing and viewing heights (on a desk 25-7/8 inches high).

The tops of the legs have to be dadoed on two adjacent sides to receive the aprons. The depth of the dadoes equals the thickness of the apron material (7/8 inch for my desk). The dadoes extend down from the tops of the leas by an amount equal to the width of the apron material minus the final thickness of the top (134 inches for my desk). The dadoes are most easily cut on a radial arm saw or on a table saw, but a hand saw, a router, or a circular saw could be used instead.

Begin assembling the desk by attaching the aprons to the legs. Make sure the legs are square to the aprons and to the ground. The desk can be assembled using finishing nails or screws, or glue and clamps. The top should fit into the assembled frame. resting on the tops of the legs.



Photo 1. The finished desk.

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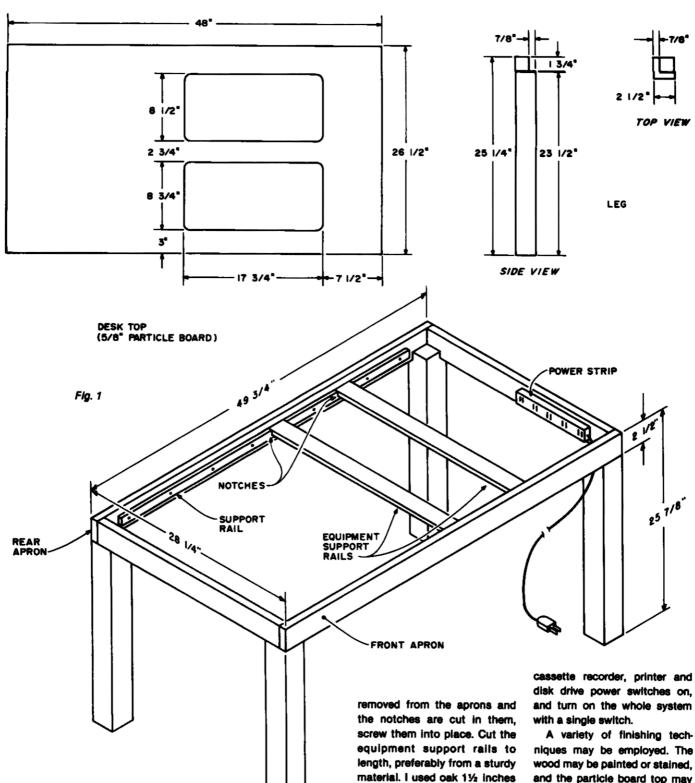


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Because the top will sag from its own weight, support it from below with rails screwed to the inside of the front and back apron pieces. The support rails can be any available scrap material, but their dimensions do not matter. Place and clamp the support rails into position when the desk top is flush with the top of the apron. Then remove the desk top, and drill 168 • 80 Micro, December 1982

pilot holes for screws through the support rails into the front and rear apron pieces. Mark locations for notches in which equipment support rails for the computer and expansion interface rest in the support rails. After the support rails are

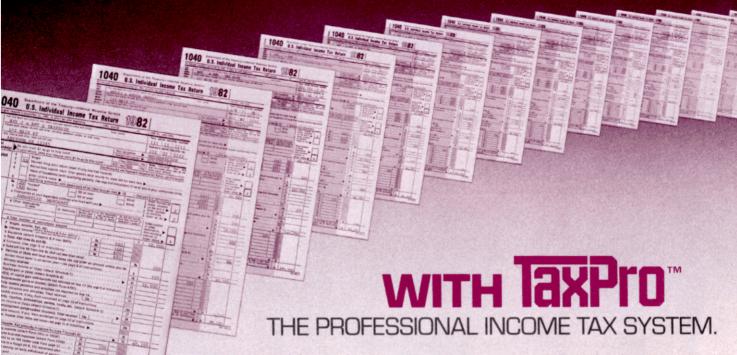
wide and 5/8 thick. Place them into position, and reinstall the desk top, completing assembly of the desk.

I installed a switched six outlet unit on the inside of the right apron, and ran all the wires through the openings in the desk top. The outlet unit which I used includes a single switch that controis power to all the outlets; I can leave the computer, expansion interface, video monitor,

and the particle board top may be painted, stained, or covered with a plastic laminate. If a plastic laminate is used it should be applied after the top is cut out. The thickness of the laminate should be considered when the thickness of the top is a factor in the construction of the desk (the length of the legs and the length of the dadoes in the legs will have to be decreased by the additional thickness of the plastic laminate).

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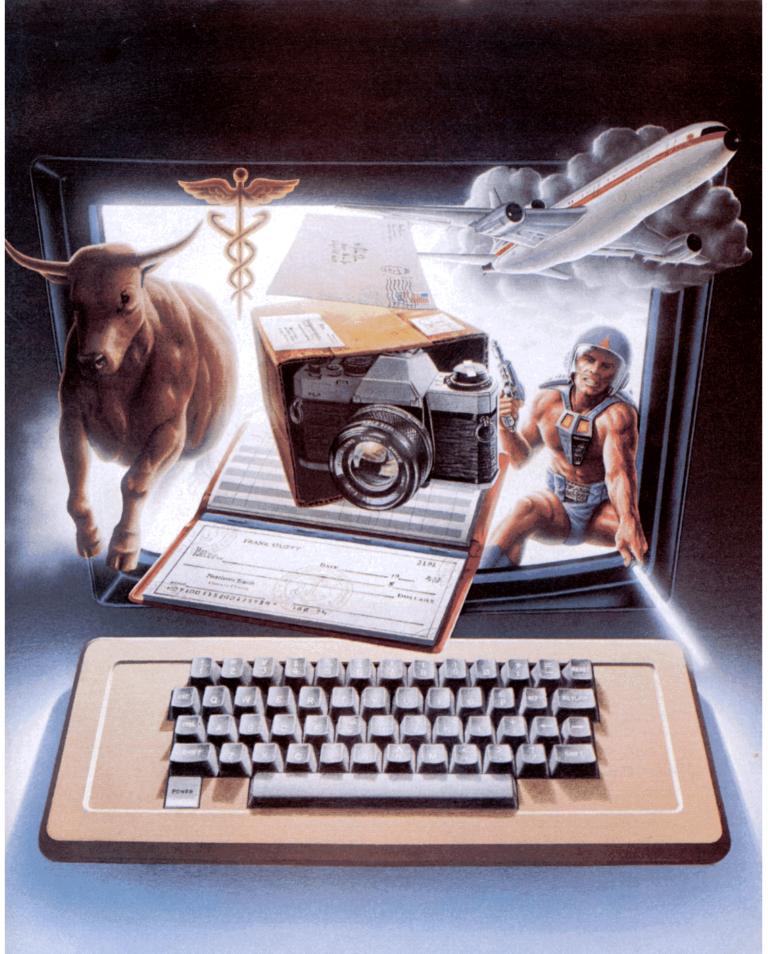
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#### Add a disk controller to your system.

#### Hardware Hacker—Part III

Philip M. Van Praag 1630 West Jagged Rock Road Tucson, AZ 85704

his article describes the design and construction of a disk drive controller for about \$200. The controller is compatible with the TRS-80 Model I, does not require the Expansion Interface, and handles up to four 51/4 inch disk drives. Its features include integral double density data separation to eliminate a potential source of read errors. single and double density operation to maintain compatibility with existing software and optimize disk storage capacity, an operator-selected disk drive disable switch enabling normal use of the TRS-80's reset function, a fully buffered interface between the controller and the disk drives, a double density status indicator and digital write precompensation to optimize data recovery accuracy.

The main logic board includes a connector card edge for mating to the standard disk drive ribbon cable assembly. The controller does not require any modification to the TRS-80 and may be combined with the 32K Memory Mod or the Centronics-compatible printer interface (presented in previous articles) or both if you desire those additional features.

The disk controller's most useful feature may be its ability to operate in double density mode. Although you must purchase a double density DOS to use this feature, it doubles the storage capacity of your disk, eventually reimbursing you for the purchase. This is accomplished by virtually eliminating clock bits (interspersed with data bits in single density opera-

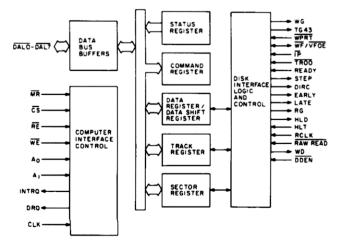
tion) and doubling the data transfer rate.

#### Requirements

The heart of the disk controller is a large-scale integrated circuit (LSI) called a floppy disk controller (FDC). As the key link between the TRS-80 and the disk drives, it performs two major tasks: first, coordinating the writing and reading of data; and second, supervising, interpreting and in some cases generating the control signals necessary for disk operation. Although the processes by which the FDC performs these functions become rather complex, all functions fall within these two general categories.

The TRS-80 always manipulates data in a parallel mode; that is, all eight data bits defining a character or instruction are presented on the eight-line data bus simultaneously. The disk drives, however, must handle data serially (one bit at a time). The FDC converts parallel data to a serial form before writing it onto the disk, and converts serial data from the disk to parallel before sending it back to the TRS-80. A data register within the FDC holds the parallelform data, and a data shift register converts it from parallel to serial and vice versa (see Fig. 1). In addition, the data must be precisely clocked when in the write mode, and this clocking must be properly interpreted when reading data from the disk.

The FDC's clock bit/data formats are referred to as frequency modulation (FM) in the single density mode, and modified frequency modulation (MFM) in the double density mode. These formats are illustrated in Fig. 2. To understand how these FM sys-



• 11	$\sim$	40 ) V <sub>DD</sub> (+12V)
₩Ē₫²		39 DINTRO
cs n	FDC	38 DRQ
RE d		37 0 *
A 0 C 3		36 WPRT
A 1 🛛 6		35 ] IP
DALO [ 7		34 TROO
DALICE		33 🕽 🛊
DAL2 [ 9		READY
DAL3 ( 10		31 D WD
DAL4 [ 11		30 D w G
DAL 5   12		29 TG43
DALE (13		28 HLD
DAL7		27 RAW READ
STEPE		26 RCLK
DIRCE		250 +
+ 🗖 17		24 CLK
+ <b>□</b> 18		23) HLT
ei 🕽 🗚		22 TEST
GND 20		211 Vcc (+5V)

PIN	1771	1791
1	VBB (-5V)	N C
17	PH3	EARLY
18	3 PM	LATE
25	XTDS	RG
33	WF_	WF/VI
37	DINT	DDEN

Fig. 1. Internal functional diagram and pin assignments for FDC

tems operate, let's look at how the disk is magnetically divided to store data.

Five levels of data organization are defined and controlled by hardware and software design. In order of size, these are tracks, granules, sectors, bytes and bit cells.

Figure 3 shows two levels of data organization on the disk: tracks (concentric rings around the disk center) and sectors (which divide the tracks into discrete pieces). A small hole in the disk (not shown) defines the relative position of the sectors around the tracks. Granules, a specific number of sectors determined by the DOS, define the smallest accessible block of data when writing to or reading from the disk. (For example, TRSDOS uses five sectors per granule, defining the smallest possible file size.) The smallest level of division is the bit cell. Each byte contains eight data bits.

This brings us back to Fig. 2. Each bit cell recorded on the disk contains two pieces of information: definition of the physical boundaries of that bit cell, and the data bit (a binary logic level high or low). In the single density mode, both data bits and clock bits are recorded. A pulse between two clock pulses defines a logic high for the bit cell. If no pulse exists, a logic low is defined for that cell. In the double density mode, clock bits are not required at each bit cell location. Instead, the relative position (or in some cases, the lack) of a logic high level bit at each bit cell location defines the cell and determines whether the cell data is a logic high or low. The rules of MFM data bit placement are in Fig. 2.

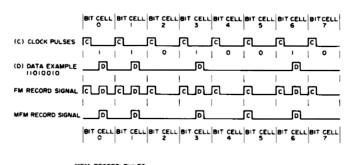
To summarize data organization on the disk, consider a few examples. In single density mode using a 35-track single-sided disk drive, there are 8 bit cells to define each byte of data, a 256 byte capacity in each sector, 10 sectors within each track, and a total of 35 tracks. Multiplying, we have 8 times 256 times 10 times 35, or 716,800 defined bit cell locations. In double density mode using a 40-track single-sided drive, there are 8 bit

cells per byte, 256 bytes per sector, 18 sectors per track and 40 tracks. This translates to 1,474,560 defined bit cell locations! Although disk storage capacity is usually specified in bytes, remember that the smallest unit of division is really the individual bit cell.

The FDC processes three general categories of signals: TRS-80-generated data, address bus codes and control signals, disk drive-generated data/feedback signals, and FDC-generated control and feedback signals.

Table 1 lists the TRS-80-generated addresses decoded by the FDC and support circuitry. These decoded addresses perform two basic functions: supplying DOS commands to operate the drives and perform housekeeping chores for FDC support circuitry; and furnishing TRS-80 memory locations (actually accessed FDC registers providing information back to the TRS-80). The TRS-80 provides read (RD), write (WR), and system reset (SYSRES) control signals. The read and write signals define the function of the TRS-80 addresses listed in Table 1 as well as provide read/ write disk drive mode instruction to the FDC. System reset. used during TRS-80 power up and reset modes, clears the FDC status register, establishes single density operating mode and performs other initialization chores in the FDC.

Disk drive-generated data and



MFM RECORD RULES

Data pulse at bit cell center if input high

Clock pulse at bit cell lead — edge if input low
and input at last bit cell was low.

Fig. 2. Single density (FM) and double density (MFM) recording formats

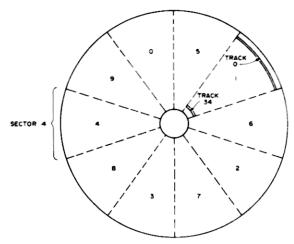


Fig. 3. Disk data organization (single-density track standard shown)

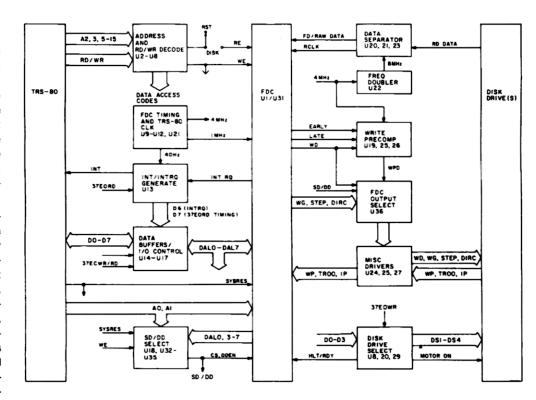


Fig. 4. Disk controller logic circuitry

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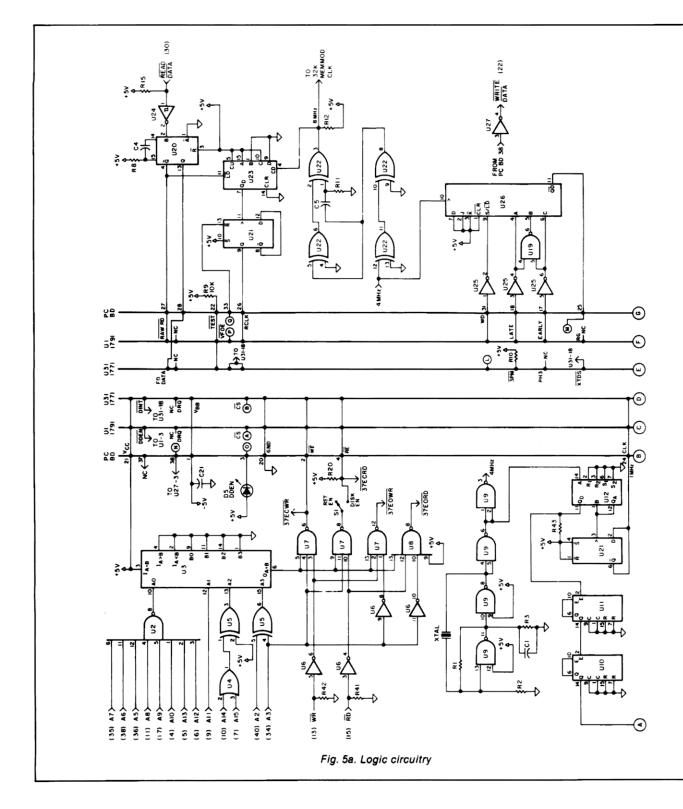


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feedback include read data (RD DATA), track zero (TR00), index pulse (IP), and write protect (WPRT) signals. The read data signal contains serial clock and data bit pulses. The track zero signal indicates when the read/write head is positioned on the outermost track (track zero). The index pulse signal provides disk sector identification by producing a pulse once per rev-

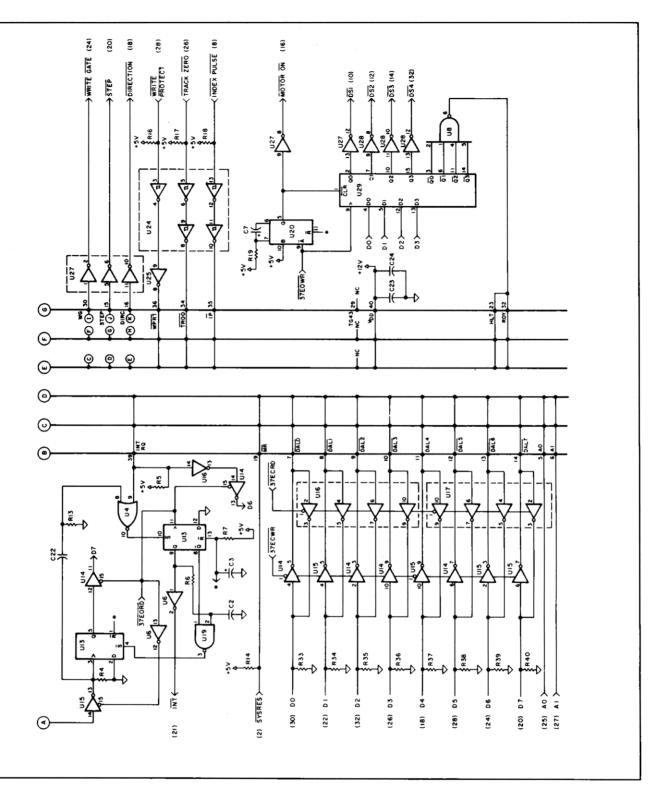
olution when the index hole is sensed. If the disk is write protected the Write command is terminated. This line is sampled every time the TRS-80 issues a Write command.

The FDC and its support circuitry generate the following control and feedback signals: interrupt request (INT RQ), interrupt (INT), and various register output signals going to

the TRS-80, as well as step (STEP), direction (DIRC), write gate (WG), and write data (WD) signals going to the disk drives. VFO enable (VFO E), EARLY, LATE, head load timing (HLT), ready (RDY) and read clock (R CLK) signals are used for internal control. Additional FDC I/O capabilities not used in this project will not be discussed.

First, let's discuss FDC sig-

nals going to the TRS-80. An interrupt request signal is generated whenever an FDC operation is completed, and is reset when a new command is loaded into the command register. The interrupt request is sent to the TRS-80 on the bit-6 data line when 37EORD is present. Its presence also causes an interrupt signal to be generated. The interrupt signal is reset at the



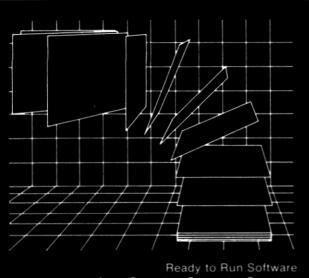
termination of 37EORD.

The five FDC registers listed in Table 1 communicate with the TRS-80 via the bidirectional data bus. The TRS-80 selects a particular register by providing a unique address (listed in the table). These addresses share the same binary address code except for the two least significant bits. Table 2 illustrates this relationship.

Now, consider FDC signals going to the disk drive. The step and direction signals control movement of the head stepping motor. A high level on the direction line sets the head inward toward the higher track numbers, while a low level sets the head outward. High level pulses on the step line move the head in increments of one track per step pulse. The write gate essentially gives permission for data to be written onto the disk, while the actual composite data (clock and data bits) is sent to the disk drives on the write data line.

Finally, let's look at FDC signals used for internal control. VFO enable indicates that the disk head is in contact with the disk and data pulses are being received. It disconnects read clock pulses when these conditions are not met, preventing read-data-line noise from affecting the FDC during non-read operations. Early and Late, generated by an FDC algorithm during write mode, aid write precompensation efforts. HLT and RDY inform the FDC that the disk drive is ready for read or write operations.

Table 3 summarizes the sig-



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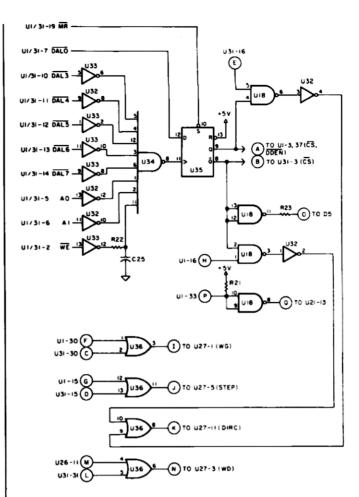


Fig. 5b. Disk controller piggyback board

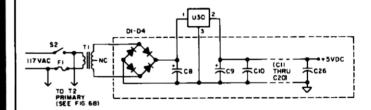


Fig. 6a. + 5 V power supply

nals necessary to provide data and control for the disk drives.

#### **How the Circuit Works**

Figure 4 contains a block diagram and Fig. 5 schematic diagrams of the disk controller logic circuitry. Table 4 contains all the miscellaneous circuit connections not shown in Fig. 5, including IC power/ground requirements and terminations for unused IC sections.

The address and read/write decoder function is accomplished by U2 through U8. U3, a 4-bit magnitude comparator, is the central focus of the decoder. It provides a high level logic signal at pin 6 whenever its two

sets of 4-bit inputs are identical. Following address bus logic levels through the input gating, pin 6 of U3 will be high when 37EO,1,2,3,C,D,E, or F appears. The presence of read and write signals, plus the gating of U7 and U8, yields the four desired outputs: 37EOWR, 37EORD. 37ECWR, and 37ECRD. A0 and A1 address lines go directly into the FDC to be used for register access together with the decoded 37ECWR and 37ECRD signals (see Table 2). The decoder does not need the A4 address line as it is always assumed low. (If it were high, with all other disk-related addresses set for disk operations,

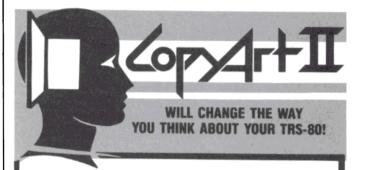
an address in the 37FX range not used for any TRS-80 function would result). Switch S1 breaks the read communication link between the TRS-80 and the disk controller when in Reset Enable mode, fooling the TRS-80 into believing the controller is disconnected. This achieves normal operation of the Reset button on the back of the keyboard.

FDC timing and TRS-80 clock signals are provided by U9 through U12, U21 and U22. U9 functions as a 4 MHz crystalcontrolled oscillator. This signal is the basis for all timing signals produced by the disk controller, including a 1 MHz FDC clock signal, a 40 Hz TRS-80 clock signal, a 4 MHz write precompensator signal and an 8 MHz timing signal used by the data separator. The 4 MHz clock is divided by two via a section of U12 and again by two using part of U21, producing the 1 MHz FDC clock. The 4 MHz clock is also divided by 10 in U12, by 100 in U11, and again by 100 in U10 to produce the 40 Hz clock signal used by the TRS-80's internal clock display routine. The 8 MHz timing signal produced by U22 functions as a frequency doubler. U22-11, U22-8, and U22-6 provide a phase-delayed 4 MHz signal to one input of U22-3. C5 and R11 produce a differentiated version of this signal for the other input. The exclusive-or function of U22-3 produces a high level output when its inputs are at different logic levels. In this application, that occurs once for every half-cycle of the 4 MHz clock, thus producing pulses at an 8 MHz rate.

U13 and its related logic circuitry-portions of U4,6,14,15, and 19-produce interrupt and interrupt-request signals. This circuitry receives two input signals: interrupt request as generated by the FDC, and the 40 Hz clock signal from U10-1. When U1-39 goes high, an interrupt signal is produced at U6-2. An interrupt is also produced when a 40 Hz signal occurs, as long as 37EORD is not active. The 37EORD signal also gates the status of the 40 Hz latch (U13-5) to the D7 data bus line, and gates INT RQ to the D6 data bus line. The termination of 37EORD, a positive-going edge, clocks a low level through U13-9 which resets the interrupt signal and, via U19-3, resets U13-5.

U14 through U17 buffer the bidirectional data bus between the TRS-80 and the FDC. These are tri-state buffers: Their outputs assume a high impedance state as long as they are disabled. All input buffers have one common enable line 37ECWR), as do all output buffers (37ECRD). The address 37EC is a memory location in the TRS-80 system to which data can be written or from which data can be read. Remember, however, that the A0 and A1 address lines are not part of the 37EC signal decoder. Therefore, enabling of the buffers also occurs for addresses 37ED, 37EE, and 37EF (see Table 2). The A0 and A1 lines, going directly to the FDC, determine which FDC registers will be accessed.

The data separator function, including U20, 21, and 23, is used in double density mode. (I didn't include a single density data separator. Considering the greater efficiency of double density, you are likely to use single density only while converting your existing programs to double density. If interest is sufficient, I will design a single density separator for a later article.) It works with two input signals-read data and a clock signal-and produces two output signals-raw read (RAW RD) and read clock. The term "data separator" as used with the 1791 is actually a misnomer as it does not separate data and clock bits. Rather, it is a data recovery system which outputs both data and clock bits on the raw read line to the FDC, and also provides a strobe or window signal for U1's R CLK to clock the raw read pulses. If a raw read pulse occurs outside the window, it will cause an FDC read error. The data separator exploits the relatively predictable recurrence of data bits to produce a clocking window which predicts the occurrence of the next data bit. The phase of the window is continuously corrected to compensate for motor speed variation and read cir-



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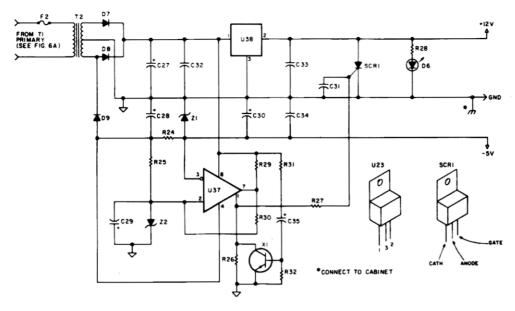


Fig. 6b. +12/-5 V power supply

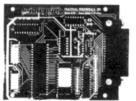
cuitry phase shifts. Remember that the read clock signal is *not* the clock bit signal coming off the disk.

U20-4,13 is a monostable oscillator which produces fixedduration pulses for the FDC based on incoming read data bits. U23 is a 4-bit count-down counter that is continually clocked at an 8 MHz rate. U21-9 divides the counter output by two, forming the read clock signal. However, this signal is terminated when the system is not in read mode by controlling U21's reset input with U1's VFOE signal.

When nothing is present on the read data line, U23 divides the incoming clock by 16. Thus, read clock signals arrive at the FDC at a 250 KHz rate. When a pulse occurs on the read data line, U20-4 goes low, which loads a 5 into the counter. Assuming the pulse occurs during

a window period, this loading action ensures that the window remains open long enough to admit the entire pulse. The loading action also phases the clock signal to the read data rate by adjusting the period of the window (and the length of time before another window opens) to suit the incoming data. This error-correcting phasing action is the essence of accurate data recovery.

Write precompensation is accomplished by U26 and portions of U19 and U25. It is used only in double-density mode to enhance data transfer accuracy. U26, a shift register, continually outputs a low level at pin 11 when no write data is present. This is a result of being in the shift state with the J and K inputs connected as shown. When a write data pulse occurs, U26 goes into the load state. during which one of the A, B, or C inputs receives a low level signal. Termination of the write data pulse reinstates the shift mode resulting in that low level bit being stepped through the



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shift register. The bit is output at pin 11 as a high level pulse some time later. The delay between the occurrence of the FDC's write data pulse and the output at U26-11 is a function of which U26 input received a low level during the load operation. The FDC determines the optimum delay that should be given to the present data pulse, based on previous write data bit patterns. As a result, a LATE or EARLY signal may be sent to U26 along with the data pulse. If neither an EARLY nor LATE signal appears, the B input (U26-5) will be low. This produces a nominal delay which would have been 250 nanoseconds longer if a LATE pulse was desired, or 250 nanoseconds shorter if an EARLY pulse was desired.

The FDC write gate, step, direction, and write data output lines are incapable of tristate operation. Thus these outputs must be isolated between the two FDCs, accomplished by U36. Fortunately, these output lines go to a logic low level when not selected, making a simple OR gate configuration possible. There is one exception: After certain operating sequences, the direction output from the operating FDC remains at a high level after switching to the other FDC. To correct for this anomaly, the direction outputs are gated with the chip select (CS) lines, ignoring the non-operating direction output line.

U27 and U28, high-current TTL buffers between the FDC and the disk drives, are capable of driving four disk drives on the common output bus. U24 is a buffer containing Schmitt-trigger action at its input to optimize signal recovery.

Switching between single and double density operation is accomplished by U32-U35. U32 through U34 form a simple decoder similar to the read/write decoder discussed earlier. The primary difference is that here several data lines are decoded. DALO determines whether single or double density mode is selected. If DALO is high when U35-11 is clocked, single density is selected; if DALO is low, double density is selected. The master reset (MR) line, called SYSRES in the TRS-80, sets U35 to single density at powerup and any time Reset is pressed. U18-11 provides a drive signal to an LED indicating double density operation.

The disk drive select circuitry activates the desired disk drive. informs the FDC when a drive is selected, and provides an enable signal with time-out protection for the drive motors. U29 is a four section latch clocked by 37EOWR. If 37EOWR does not go low at least once every three seconds U20-5 will go low and U29 is cleared, turning off the drive motors and the previously selected drive. When any drive is selected U8-6 will be high.

#### Construction

Table 5 contains the parts lists for this project. Use of printed circuit boards is almost mandatory due to circuit complexity. You might try wire-wrap if you have considerable experience in this area, but wiring errors are difficult to dynamically trace because most signals processed by the controller are non-recurrent.

Figure 7 contains full-size. double-sided etch patterns for the disk controller and power supplies. If you choose to build your own board and cannot provide plated-through holes, then you must not use IC sockets. Without plated-through holes, provide conductor path connections from one side of the board to the other by inserting a wire through each hole and soldering the wire on both sides. Use of IC sockets precludes the possibility of soldering to the donut pads on the component side of the board. All non-component holes (over 200!) require bare wires inserted, soldered on both sides, and then clipped short. It is really much easier to use a board that has plated-through holes.

Figure 8 contains a parts layout guide for the PC boards. Be careful to orient the ICs, diodes, and capacitors as shown. If you use IC sockets, line up the dot or notch on the socket (indicating pin 1) with Fig. 8 to aid subsequent IC insertion. Use only a low-wattage



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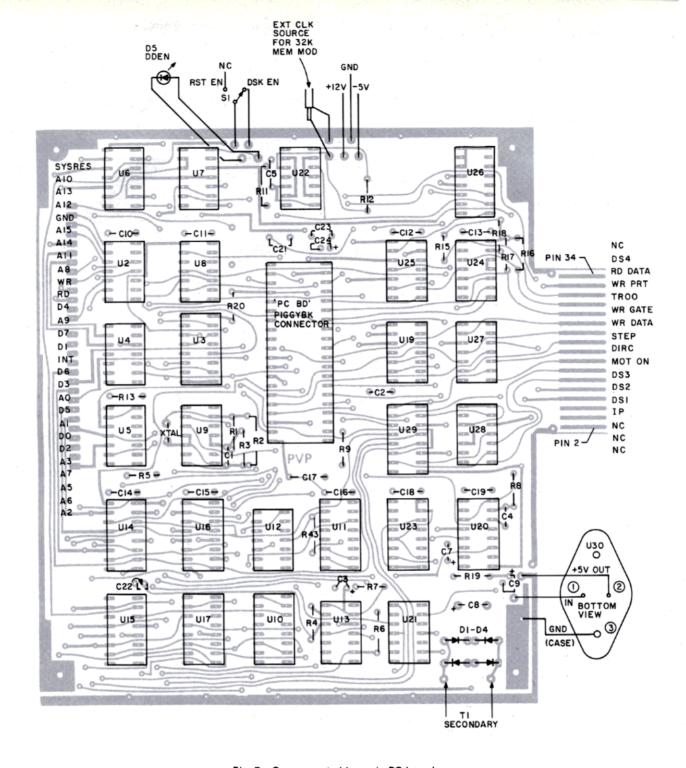


Fig. 7a. Component side, main PC board

iron (25 watts) with a fine tip, and .030 inch solder.

The piggyback PC board connects to the main PC board via two 20-pin strips arranged in a 40-pin-IC-style pattern. Insert and solder the shorter side of the pin strips at the second and fourth 20-pad rows from the left (see Fig. 8c) on the piggyback board. Insert the pins through the board from the non-component side, allowing about 1/16 inch of the pins to protrude 182 • 80 Micro, December 1982

above the component side; then solder in place.

When all components except U1 and U31 are installed on the PC boards, take a few moments to carefully inspect your work. Use a magnifying glass and good lighting to check all solder connections, component placement, polarities, and so on. A few extra moments is good insurance against trouble later on. When satisfied with your work, plug the piggyback board into

the 40-pin socket on the main PC board, being careful to observe proper pin 1 orientation. Apply firm even force to avoid bending the pins.

Three power supply voltages are required for this project: +5 volts, +12 volts, and -5 volts. The +5 volt supply is on the main PC board, except its power transformer (TI), fuse and voltage regulator IC (U30). Since the case of U30 is at ground potential it can be mounted to

whatever metal cabinet you choose to house the controller, eliminating the cost of a separate heat sink. If you mount U30 to the cabinet, be sure to remove any paint from the regulator mounting surface, and use heat sink compound to optimize heat transfer.

The +12 and -5 supply voltages are from a separate PC board (see Fig. 8d). (This is the same PC board used in the 32K Memory Mod project.) A few

components are deleted from the 32K design. If you have already built the 32K Memory Mod, use its +12 and -5 volt outputs to power this project: there is more than enough current reserve for those voltages. However, the +5 volt supply on the 32K mod version is not adequate to operate the disk controller, and should not be used for that purpose. (This is why the +5 volt components are not on this power supply board, and a +5 supply is included on the main PC board.) Mount R24 and R25 on the +12/-5 volt supply about 1/4 inch above the PC board to aid heat dissipation. Three wires (+12, -5) and ground) provide cabling from the + 12 and -5 volt supply outputs shown on Fig. 8d to the appropriate inputs on the main PC board as shown on Fig. 8a. U38 may be heatsunk to the cabinet in the same manner as U30. since its mounting tab is at ground potential.

The cabinet chosen for this project should be metal, preferably aluminum for ease of cutting and drilling. The cabinet in Table 5 is all aluminum, large enough to accommodate the disk controller and the 32K Memory Mod and printer Interface projects presented previously. Figure 9 illustrates the proper orientation and connection of the TRS-80 interface ribbon cable to the controller PC board. It also shows the proper orientation of the disk drive cable connector with respect to the output card edge. If the board is mounted in the cabinet as shown (with the component side facing down) the disk drive connector will be oriented in the traditional manner; that is, the ribbon cable will exit the bottom

of the connector.

If you use the ribbon cable and connector listed in Table 5 first slip the cable through the slot in the connector rear. Then, while holding the cable straight, squeeze the connector closed using an ordinary vise.

Finally you must add 10 termination resistors at D0-D7. WR, and RD. Resistors R33-R42 (shown in Fig. 5a) may be mounted on the underside of the main PC board (see Fig. 8b). If you intend to combine the disk controller with one or both of the previous projects, you may mount the resistors on the ribbon cable PC board to be presented in the next article. Even if you do not intend to add the other two projects at this time, you may prefer to include the cable PC board to allow future expansion and ease addition of the termination resistors.

If you opt for adding resistors to the disk controller board, refer to Fig. 8b. Mount the resistors flat against the PC board, with one lead of each resistor soldered to an appropriate IC pad. The other leads of the resistors are soldered together and then to any convenient location on the ground bus running along the outer edge of the board. Use insulated wire to prevent inadvertent shorting to the PC board.

## Installation and Operation

Before inserting U1 and U31 it is wise to perform the following test. With all other ICs installed and double-checked for proper orientation, apply power to the circuit. The LED (D6) should illuminate. If it does not, disconnect power immediately and find the problem before reapplying power. A voltmeter/ohm-

TRS-80 Address	
Code	Function
37E0 WR	Supplies CLK sig to activate disk motor in selected drive
37E0 RD	Clks 40Hz Timing and INTRQ sigs to TRS-80, then resets INT
37EC WR	Writes TRS-80 data into FDC Command Register
37EC RD	Resets INTRQ and accesses FDC Status Register to TRS-80
37ED WR/RD	Accesses FDC Track Register to TRS-80
37EE WR/RD	Accesses FDC Sector Register to TRS-80
37EF WR/RD	Accesses FDC Data Register to TRS-80

Table 1. Addresses used for disk operations



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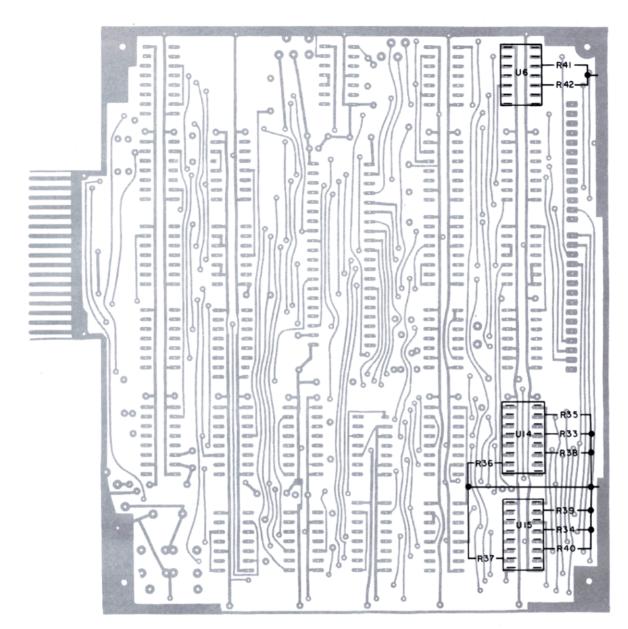


Fig. 7b. Reverse side, main PC board



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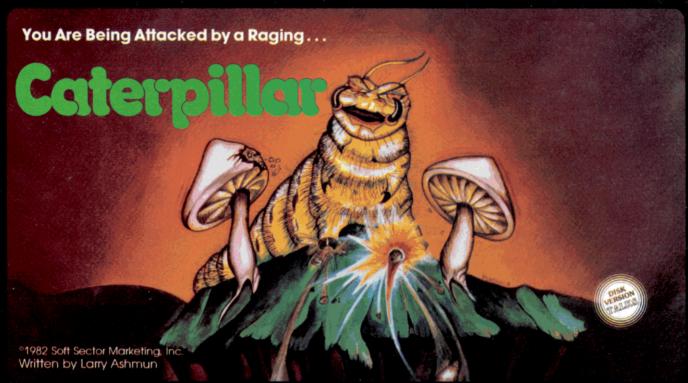
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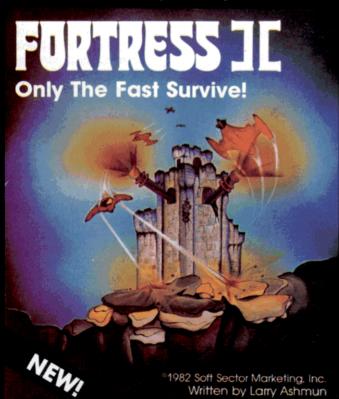
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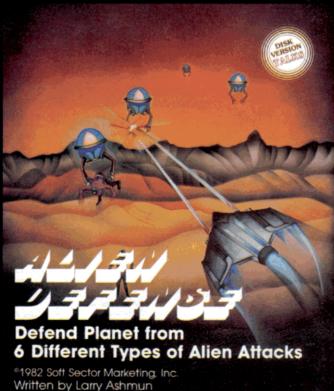
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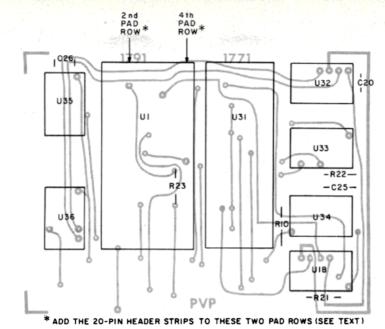


Fig. 7c. Component side, piggyback PC board

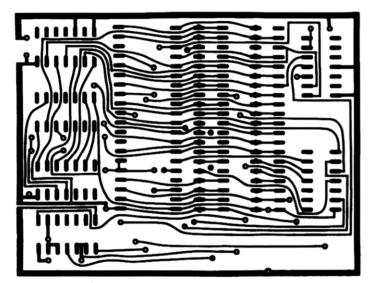


Fig. 7d. Reverse side, piggyback PC board D6 +12V C27 C32 C 33 GND -5V XFMR SEC OUT R30 C30 ZΙ XFMR SEC (WINDING ENDS) ODE I R32

Fig. 7e. +12/-5 V power supply

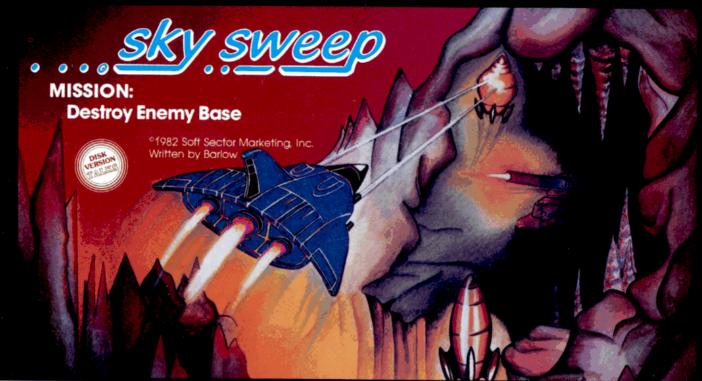
meter is handy for this type of troubleshooting. Assuming the LED illuminates, leave the power on for 30 minutes and then touch the power transformers to see that they are moderately warm, not hot. If you have access to a voltmeter, check voltages at U31 socket pins 1, 21 and 40 for -5, +5 and

+12 volts respectively. Then shut off the power and install U1 and U31. (Never install or remove ICs while power is applied). Repeat the power supply temperature test. If all is well, connect the disk controller to the TRS-80 and your disk drives. To keep things simple, it is best to test the system in single density mode (be sure to have S1 in the Disk Enable position). Do not use master disks until you are certain all functions are operating correctly.

After everything is operating properly, proceed to the double density checkout using your double density DOS. The double density indicator LED can be used as an educational tool as well as a software troubleshooting aid when operating in double density mode. The lighting sequence provides insight into the way double density is implemented on the TRS-80.

For example, what occurs during a double density systembackup operation? Assuming that the system disk boots properly, the LED is on prior to the backup routine. When the appropriate backup command is entered, the program first formats the blank disk. The disk head/carriage assembly moves toward track zero to begin formatting and then the LED goes off briefly. We are trying to reproduce a double density program on what will be a doubledensity formatted disk-why does this happen? By default, the TRS-80 system must go to single density on powerup and Reset modes to preserve compatibility with all existing single density software. The command telling the system to go to double density must, itself, be written in single density! At powerup and Reset (via ROM) the disk drive reads track zero; track zero must be formatted for single density operation. Watch both the LED and the video monitor track indication. The LED goes back on at track one. Similarly, when formatting is complete and the write/read sequence begins, the LED again shuts off at track zero.

When S1 is switched to the Reset Enable position, the disk drives are disconnected as far as the TRS-80 is concerned, permitting normal operation of the Reset button. S1 must be in the Disk Enable position when the disk drives are to be used.



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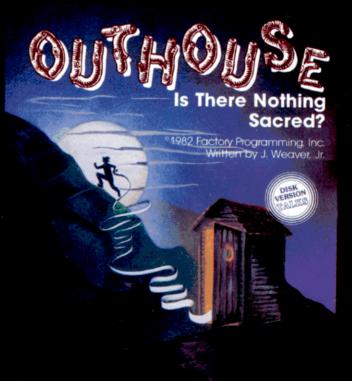




# RPPRP

**Don't Chicken Out!** 

©1982 Factory Programming, Inc. Written by J. Weaver, Jr.



Address					В	inary C	code										
	A15	A14	A13	A12	A11	A10	A9	<b>A8</b>	A7	A6	A5	A4	A3	A2	A1	A0	
37EC	0	0	1	1	0	1	1	1	1	1	1	0	1	1	0	0	
37ED	0	0	1	1	0	1	1	1	1	1	1	0	1	1	0	1	
37EE	0	0	1	1	0	1	1	1	1	1	1	0	1	1	1	0	
37FF	0	0	1	1	0	1	1	1	1	1	1	0	1	1	1	1	

Table 2. FDC register access codes

Signal	Source
(Parailei) data	TRS-80
Address bus codes	
Read	
Write	
System Reset	
Read data	Disk drive(s)
Track zero	
Index pulse	
Write protect	
Interrupt request	FDC and suppor
	circuitry
Interrupt	
Register outputs	
Step	
Direction	
Write gate	
Write data	
VFO enable	
Early	
Late	
Head load timing	
Ready	
Read clock	

				The second second
			4 4	
:	¥	•		
7				
1				

Photo 1. Disk controller cabinet

IC Pow	IC Power and Ground Connect			ections Additional IC Connec				
IC	Туре	+ 5V	GND	IC	Pin	Destination		
	,,,							
U1°	FD1791-02	21	20	U4	5	GND		
U2	74LS30	14	7	U4	6	GND		
U3	74LS85	16	8	U4	11	GND		
U4	74LS02	14	7	U4	12	GND		
U5	74LS86	14	7	U5	9	+5		
U6	74LS04	14	7	U5	10	+5		
U7	74LS10	14	7	U5	12	+5		
U8	74LS20	14	7	U5	13	+5		
U9	74LS00	14	7	U15	12	GND		
U10	CD4518	16	8	U16	12	GND		
U11	CD4518	16	8	U16	14	GND		
U12	74LS90	5	10	U16	15	GND		
U13	74LS74	14	7	U17	12	GND		
U14	74LS367	16	8	U17	14	GND		
U15	74LS367	16	8	U17	15	GND		
U16	74LS367	16	8	<b>U19</b>	9	+5		
U17	74LS367	16	8	U19	10	+5		
U18	74LS00	14	7	U19	12	+ 5		
U19	74LS00	14	7	U19	13	+5		
U20	74LS123	16	8	U21	1	GND		
U21	74LS74	14	7	U25	11	GND		
U22	74LS86	14	7	U25	13	GND		
U23	74LS193	16	8	U28	1	+5		
U24	74LS14	14	7	U28	3	+5		
U25	74LS04	14	7	U28	5	+5		
U26	74LS195	16	8	U32	5	GND		
U27	7416	14	7	U35	4	GND		
U28	7416	14	7					
U29	74LS175	16	8					
U30	LM309K	(see F	ig. 8a)					
U31**	1771-1	21	20					
U32	74LS04	14	7					
<b>U33</b>	74LS04	14	7					
U34	74LS30	14	7					
U35	74LS74	14	7					
U36	74LS32	14	7					
U37	LM311N	(see F	ig. 6b)					
U38	LM340T-12	(see F						
*Pin 40	): + 12 V							

\*\*Pin 1: -5 V, Pin 40: + 12 V

Table 4. IC power, ground and additional connections

Several good double density DOS programs are available. Percom's DBLDOS is a double density system operationally very similar to Radio Shack's TRSDOS. DBLDOS routines convert files from single to double density and vice versa. A more sophisticated DOS, NEWDOS80, is now available in a double density version. Other double density operating systems compatible with the hardware supported in these two systems should also work, but I have not used them. The disk controller can be used with any single density DOS compatible with Radio Shack's Expansion Interface.

"Percom's
DBLDOS is a
double density
system
operationally
very similar
to Radio Shack's
TRSDOS."

Any double-density-rated Model I-compatible disk drives (such as Tandon's TM100-1) can be used with this system. Shugart SA400 disk drives (these are the Radio Shack-provided Model I drives), probably operate properly in double density; but they are officially rated only for single density. Shugart



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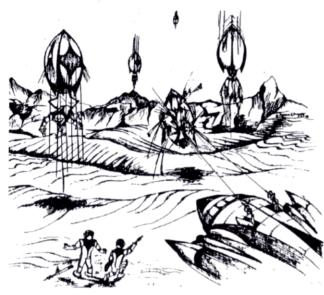


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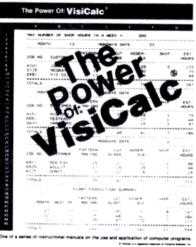
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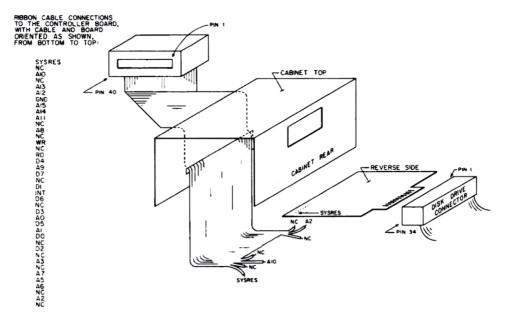


Fig. 9. Ribbon Cable

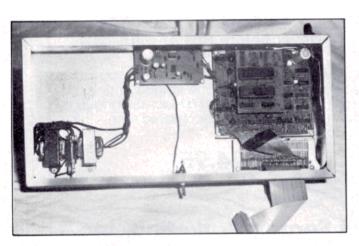


Photo 2. Internal view of disk controller

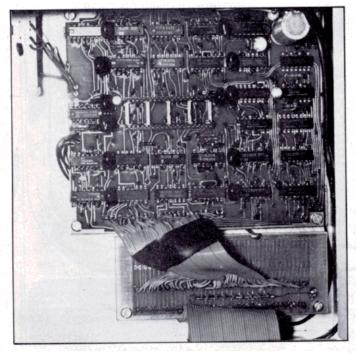


Photo 3. Detail of disk controller and ribbon cable PC boards

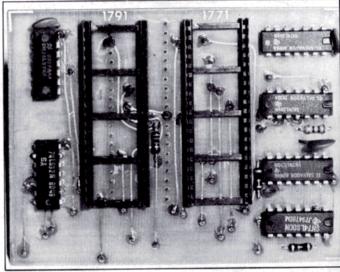


Photo 4. Disk controller. Component side of piggyback PC board

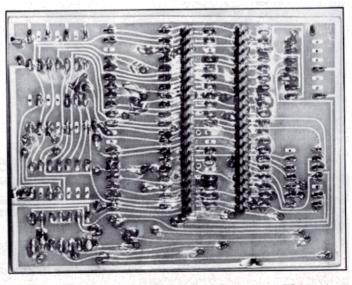


Photo 5. Disk controller. Reverse side of piggyback PC board

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LARGE LIST SUPPORT - The multi-drive operation allows the user to access data files on ALL configured drives CONCURRENTLY (at the SAME hmy) for Inuly large mailing lists. Files need not be sectioned into smaller "byte size" chunks to fit into memory.

HARD DISK SUPPORT ~ (HARD DISK POSIMAN only) The FULL utilization of the space and speed of the new hard disk drives is possible with POSIMAN For example, a 7.5 megabyte drive can be configured to hold almost 60,000 labels. Multiple hard drives can be accessed CONCURRENTLY allowing 200,000++ entry mailing lists.

FORM LETTER CAPABILITY - With the purchase of the separate POSTRITE program, the user is provided with an easy to use form letter generator which will merge a generalized letter produced from a word processing system (i.e. LAZY WRITER, etc.), with the name and address information from the POSTMAN MASS MAILER data base. POSTMATER allows the user to insert any field from a POSTMAN label entry anywhere in the letter.

MENU OPERATION - As you would in a restaurant, choose your dinner from a list (or MENU) POSTWAN will allow you to direct its actions by selecting from various menus that if will display A complete discussion of each menu is presented in the manual.

INSERT – New names can be quickly added to your list at any time. The new addresses are placed into the file in their proper sorted order eliminating, the need for a separate sort operation offer entering a stack of new names POSTMAN will allow the operator to enter a "botch" of labels without returning to the control menu between each label insertion, thus speeding entry and reducing the aggravation of extra menu control keystrokes.

DELETE - Names can be removed at any time when they are no longer needed

EDIT – Information in any name entry can be quickly changed at will with "word processor" ease. A "transparent" cursor simply is moved to the label displayed on the computer screen and corrections are just typed over the existing label. If you happen to change a field which is also used as a soft key. POSTMAN will automotically move the changed label to its correct position in the list to maintain the softed arrangement of the labels.

**OVERLAY** – When identical changes are needed on many addresses, the OVERLAY feature can make them with one keystroke. The needed changes which are common to many ideals are entered into the "overlay mask". When you wish to apply these common changes to any label, one command will do it.

**SORT** – Arrange your list in any alphabetic or numeric order. The ordering may use one or more fields to control the sort. A machine language heap sort assures fast execution. The sort need only be performed once, the sorted list will stay sorted through all subsequent insertions, deletions, and changes to existing labels. NO NEED to leave the POSTMAN program to use a separate program to sort your data. Your data is sorted quickly and after sort completion, POSTMAN is ready for your next command!

SPECIAL STREET ADDRESS SORT – For the user with many addresses on the same street POSTMAN will sort your entries by the house NUMBER after grouping those on the same street together. Local city lists can be quickly sorted to aid post office dispatching.

**PURGE** - Unwanted duplicate addresses can be removed from your list automatically or under operator control.

SEARCH - Any address in your list can be quickly found with fast search and positioning commands. Three different types of searches are provided A "fast" search which uses a hashing technique, a "selective sequential" search for labels with common fields, and "quick" positioning using the first or major sort field to get you into the general "ball park" of a label or sequence of labels.

LABEL PRINTING - One, a few or all addresses in your list can be printed on standard or nonstandard lobel stock. Up to 6 lobels across can be printed with a format YOU can easily control TWO user definable: ATTN lines are provided for any use. Labels can be printed from many of POSTMAN's menus, search, edit, or during label insertion.

EFFICIENCY – POSTMAN is written in the machine's native language to gain the full advantage of the microcomputer's speed. Extensive use of program segmentation reduces the amount of use RAM needed to hold the program, allowing a greater number labels to be kept in core, resulting in faster operation. Little used routines need only be brought into memory when they are needed and once through with their task, release their space back to POSTMAN.

REPORT LISTINGS – A special program to produce columnar listings of address data from your label data base is provided. You can easily specify the information to be printed.

DATA DISK NEEPONG – Labels can be quickly transferred from one disk to another with the PSTMERGE program callable from the main POSTMAN SYSTEM menu. Source and destination drives needed not be separate drives, prompts to exchange diskettes if the same drive is used, are provided

DATA DISK PREPARATION UTILITY - Provided with POSIMAN is the DPREP program which allows the user to prepare a floppy/hard task for use with POSIMAN This easy to use utilify can be told to prepare any portion of the avoilable space on a disk.

DATA INTEGRITY - All data transfers to the disk files are made using special write commands which instructs the operating system to check the validity of EACH write to the disk

DATA GUARD\* — is a special programming technique only offered by Soft Sector Marketing, inc. if by chance your machine resets while writing information to the disk, you only lose the information that you were writing. Your files are always protected from the danger of losing all the work that you have put in that day NO OTHER PROGRAM ON THE MARKET OFFERS THIS PROTECTION. If you reset with ANYBODY'S MAILING PACKAGE DURING WRITING you would destroy your ENTIRE data disk. We can't stop your machine from failing but we can protect your data.

#### Description of Label Record Fields:

Length	Name	Description	Length	Name	Description			
10	Code	User defined printable field	15	City	City, township, village			
15	Last Name	Last name of addressee	5	State	State, province, territory			
15	First Name	First name of addressee	9	Zip	Zip code, zone, route			
26	Company	Name of company	2	Data 1	User definable field			
26	Address	Street address	5	Data 2	User definable field			

## **IDEAL SYSTEM**

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\*Special version to work on Dosplus 4.0 Hard Disk operating system.

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The POSTMAN system requires Mod I or Mod III, 48K, 2 disk drives minimum.

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#### Parts required for disk controller including +5 volt power supply: (Designator C6 is not used.)

U1	FD1791-02 IC
U2,U34	74LS30 IC
U3	74LS85 IC
U4	74LS02 IC
U5,U22	74LS86 IC
U6,U25,U32,U33	74LS04 IC
U7	74LS10 IC
U8	74LS20 IC
U9,U18,U19	74LS00 IC
U10,U11	CD4518BE IC
U12	74LS90 IC
U13,U21,U35	74LS74 IC
U14,U15,U16,U17	74LS368 IC
U20	74LS123 IC
U23	74LS193 IC
U24	74LS14 IC
U26	74LS195 IC
U27,U28	7416 IC
U29	74LS175 IC
U30	LM309K IC
U31	FD1771-01 or INS 1771-1
U36	74LS32 IC
R1,R7,R33-R40,R42	1,000 ohm, ¼ W, 5%, resistor
R2,R3,R12,R43	3,300 ohm, ¼ W, 5%, resistor
R4,R6	4,700 ohm, ¼ W, 5%, resistor
R5,R8,R9,R10,R14,R20,R21	10,000 ohm, ¼ W, 5%, resistor
R11	8,200 ohm, ¼W, 5%, resistor
R13	1,500 ohm, ¼ W, 5%, resistor
R15,R16,R17,R18	150 ohm, ¼ W, 5%, resistor
R19	68,000 ohm, ¼ W, 5%, resistor
R23,R41	470 ohm, ¼ W, 5%, resistor
R22	330 ohm, ¼ W, 5%, resistor
C1,C25	100 pF, ceramic disk capacitor
C2 C3.C7.C9	200 pF, ceramic disk capacitor 100 uF, 10 V, electrolytic capacitor
C3,C7,C9 C4	47 pF, ceramic disk capacitor
C5	10 pF, ceramic disk capacitor
C8	4,500 uF, 10 V, electrolytic capacitor
Ca	4,500 UP, 10 V, electrosytic capacitor
C10-C19,C21,C23	.1 uF, 50 V, mylar capacitor
C20C26	.1 uF, 12 V, ceramic disk capacitor
C22	.001 uF, mylar capacitor
C24	10 uF, 16 V, electrolytic capacitor
S1.S2	SPST toggle switch
D1-D4	1 A. 100 PIV diode
D5	LED (Digikey NSL5053 or equivalent)
F1	3/8 A, 3AG (fast acting) fuse

XTAL

T1

Miscellaneous

(Triad F-14X or equivalent)

PC boards, cabinet (Bud AC-412/BPA-1520 or equivalent—see text), AC line cord, two 20-pin male header strips (AP Products 929834-08 or equivalent), 40-conductor ribbon cable with matching "TRS-80 keyboard card-edge compatible" connector (Radio Shack 278-771/276-1558 or equivalent), IC sockets (one of the 40-pin sockets must be capable of accepting .025 inch square posts—JDR Microdevices "40PIN-ST" is a good choice), hardware (including threaded standoffs to mount the PC boards).

4 MHz crystal, HC18/U style (NDK-040S or equivalent)

6.3 volt AC. 1.2A "filament" transformer

### Table 5. Parts list

believes all units after serial number 80000 are okav, as are about 80 percent of all those below 80000). I experimented with two very early units (serial numbers well below 10,000) and achieved partial compatibility. They boot the double-density DOS and perform flawlessly most of the time. However, they occasionally fail operations which involve writing and subsequent read/verifying "worst case" data bit combinations (eg: 6DB6H).

It is best to apply power to the disk controller before turning on the keyboard. Reverse this sequence when removing power. Also, apply power to the controller before inserting disks and remove all disks before turning off power. That way, even if transient voltages conspire against you, your disks will be safe. ■

Readers of 80 Micro are welcome to use the etch patterns contained in this article to construct the Disk Controller for their personal use only.

An etched and drilled epoxyglass PC board set with platedthrough holes as shown in Fig. 7 is available for \$54.95. A complete kit of parts is also available, including PC boards, the 1791/1771 controllers, cabinet (no holes or cutouts, but dimensional layout is included), IC sockets, and all other parts listed, including the +12/-5volt power supply for \$219.95. The 1791/1771 controller set is available separately for \$69.95. (There will be a predrilled, punched, painted, and labelled version of the cabinet available for the complete system in the final article of this series. If you would like to order the kit of parts as above, but without the blank cabinet, deduct \$20.00

from the kit price.)

If you have already built the + 12/-5 volt supply for the 32K memory mod project, you may order either the PC board set or parts kit for the disk controller without components for this supply. The PC board set without power supply board is \$49.95, and the parts kit without + 12/ - 5 volt power supply components is \$204.95.

The above prices are postpaid in the continental U.S. Arizona residents add 4 percent sales tax. Order from PVP Industries, P.O. Box 35667, Tucson, AZ 85740.

#### Parts required for + 12/ - 5 volt power supply:

U37	LM311N IC (do not substitute)
U38	LM340T-12 IC
SCR1	R122B (R/S 276-1067 or equivalent) SCR
D6	LED (Digikey NSL5053 or equivalent)
Z1	5.1 V, 5%, 1/2 W (1N5231B) zener diode
<b>Z2</b>	4.3 V, 5%, 1/2 W (1N5229B) zener diode
C27	1000 uF, 25 V, electrolytic capacitor
C28	220 uF, 25 V, electrolytic capacitor
C29	220 uF, 10 V, electrolytic capacitor
C30	4.7 uF, 10 V, electrolytic capacitor
C31	.001 uF, 25 V, ceramic disk capacitor
C32-C34	.1 uF, 50 V, ceramic disk capacitor
C35	10 uF, 25 V, electrolytic capacitor
R24,R25	390 ohm, 1/2 W resistor
R26	2.2K ohm, 1/4 W resistor
R27	1.2K ohm, 1/4 W resistor
R28,R29	1K ohm, 1/4 W resistor
R30	100K ohm, 1/4 W resistor
R31,R32	10K ohm, 1/4 W resistor
D7-D9	1A, 100 PIV, diode (1N4002 or equivalent)
T2	24 VAC, .8A center-tapped transformer
	(Burnstein Applebee 18A1833-3 or equivalent)
F2	3/8A, 3AG (fast acting) fuse
X1	MPS3705 transistor (general purpose, NPN)

#### Miscellaneous

PC board, in-line fuseholder, hardware.



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c o n



# Add search to Level II Basic.

# The Looking for Z\$ Blues

J. E. Hieber 725 Idlewild Road Bel Air, MD 21014

is to eyeball the code line by line.

The Assembly routine in the Program Listing adds the omitted search function. The program interfaces with Level II's normal command structure; the new commands are entered from the Basic prompt.

The search is executed from

play forward or backward one line, the ability to reset the current line pointer to the beginning of the program, and the ability to enter the Edit mode with an abbreviated command.

I thought the new commands should be meaningful, short, and handy. All commands end with should be no more than 63 characters. Excessively long search arguments can cause the system to bomb.

The semicolon command advances the display one line. Press the semicolon and enter keys repeatedly to step through a program.

The minus sign steps the display one line backward. Minus can also be hit repeatedly.

The period resets the current line pointer to the first line of the program. This is handy to reset the pointer before a new search sequence.

The edit command is entered with the first letter (E) reducing the keystrokes needed to enter the edit mode. The semicolon and minus commands can be appended to the edit abbreviation to edit the next line and previous line, respectively.

The at sign (@) displays the current line.

The techniques and hooks in the program can be used to add other commands and features.

John Hieber, a graduate engineer and mathematician, first programmed an IBM 650 in 1963. He has owned a micro for about two years.

"The length of the search argument should be limited to no more than 63 characters."

The lack of a search function is a serious limitation of the TRS-80 Level II cassette system. How often have you wanted to know every place a variable is used in a program? The only way

The Key Box

Basic Level II Model I 16K RAM the current line pointer toward the end of the Basic program in memory. If the search argument is found, the line is displayed and the current line pointer is set to that line. Continue the search by entering the search command with no argument. If the search argument is not found, the Basic Ready is displayed and the current line pointer is not changed.

Along with searching I added the ability to advance the dis-

the enter key. Table 1 lists the commands.

The quotation marks call the search function. This works well with variables and characters within REM statements. Basic keywords such as GOTO, IF, and SET cannot be found. These keywords are stored as single character tokens in program memory. An alternate search command, the colon, is used to search for the keywords. The length of the search argument



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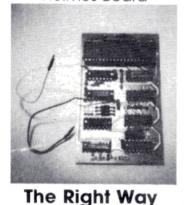
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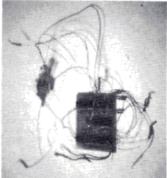
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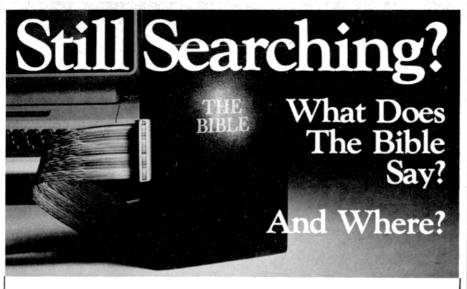


Command	Explanation
" 1	Search for variable I1 (argument should be < 64 characters)
:GOTO	Search for keyword GOTO
	Reset current line pointer to first line of the program
-	Step display one line backward
<b>@</b>	Display current line
;	Step display one line forward
E	Edit current line
E	Edit previous line
E;	Edit next line

Table 1. New Level II Commands

### Program Listing

		•	•	
	00100 :THIS R	OUTINE ADI	DS A SEA	RCH FUNCTION TO LEVE
L II, TO				
•				LOCATE GIVEN CHARACTER
	00120 ;STRING			
ON DOD	00130 ;THIS R	OUTINE WI	LL ALSO	PROVIDE SHORT NOTATI
ON FOR	00140 ;LIST A	ND EDIT C	S. S. C.	THE ABILITY TO SIN
GLE	00140 ,6101 /	LID EDIT C		IIID REPERT TO DEE
	00150 ;STEP F	ORWARD AN	D BACKWA	RD THROUGH A PROGRAM IS
	00160 ; INCLUD	ED.		
	00170;	LID T MM CN	nv. 7 n	UYEDED
	00180 ; 00190 ;	WRITTEN		. HIEBER AIR, MD. 21014
	00200;			,
	00210;	COPYRIGH	T APRIL	1981
	00220 ;	TIONING I	C & C!!MM	INDV OR THE COMMANDS
ADDED:	DD230 ;THE FC	DLLOWING I	S A SUMM	IARY OF THE COMMANDS
ADDED:	00240 ;			
	00250 ; E; V	VILL EDIT		
		VILL EDIT		
		VILL EDIT		
				E (AT SIGN)
	00300 ; - V	VILL LIST	PREVIOUS	LINE
	00310 ; .	VILL SET T	HE POINT	ER TO START OF THE P
ROGRAM	00320 ; "CHAI	RAC STRING	WTT.T	SEARCH THE BASIC PROGRAM
	00330 ; "CHAI	C DIKING		MATCH
	00340 ; :CHA	RAC STRING		SEARCH FOR BASIC KEY
WORDS				
	00350 ;		SUCH AS	GOTO, IF, THEN, ETC.
	00360 · " OP	. WITH A	NULL STE	RING WILL USE THE PRE
VIOUS	DESCE ; OK	. WIIN A	NOLL SIF	ANG WILL OSE THE FRE
.1000	00370 ;	STRING A	ND CONTI	NUE THE SEARCH
	00380;			
41B2	00390 CMDHK:	EQU	41B2H	; HOOK FROM ROM COMMAND
1B2C	00400 00410 FLNO:	EQU	1B2CH	; PROCESSOR ; FIND THIS LINE NO =
DE	00110 12.01	-40		
40EC	00420 TLNO:		40ECH	;THIS LINE NO.
Ø6CC	00430 BASCE:		Ø6CCH	ROM BASIC ENTRY
41E6 40A4	00440 BUFAD: 00450 BASPT:	EQU EQU	41E6H 40A4H	; COMMAND BUFFER ; BASIC PROG BUFFER
403E	00460 PRVRQ:		403EH	; PREV DEC SIZE
4040	00470 STRLN:	EQU	4040H	STRING LENGTH
4041	00480 LNPTR:	EQU	4041H	; TEMP LINE POINTER
4043	00490 STRING	: EQU	4043H	; SEARCH STRING
7ECD	00500 ; 00510	ORG	7ECDH	; 32461
7ECD 21E37E	00520 JEHMN2		HL,START	
ADDR	<b></b>			
7EDØ 22B341	00530	LD	(CMDHK+)	
7ED3 3EC3 7ED5 32B241	00540 00550	LD LD	A,ØC3H (CMDHK)	;JP CMD TO ROUTINE
7EDS 32B241 7ED8 C3CC06	00550 00560	JP	BASCE	JUMP TO ROM BASIC
7EDB 2AA440	00570 MOVTP:	LD	HL, (BASI	
BUFFER				
7EDE CD667F	00580	CALL	LODLA	; LOAD LINE NO OF FIR
ST LINE	44504	TD	BLDC3	;LIST LINE
7EE1 1834 7EE3 F5	00590 00600 START:	JR PUSH	AF	;SAVE REG
7EE4 D5	00610	PUSH	DE	
7EE5 E5	00620	PUSH	HL	
7EE6 C5	00630 00632	PUSH LD	BC A,5	; CHECK FOR NULL CMD
7EE7 3EØ5 7EE9 B9	00632 00634	CP	C C	; LINE NO WITH NO LINE
7EEA 2867	00636	JR		;YES RETURN
7EEC 23	00638	INC	HL	POINT TO NEXT CHARA
C IN CMD	22612			TOND ICM DVMP
7EED 7E	00640 00650	LD CP	A,(HL)	;LOAD 1ST BYTE ;IS THIS A SEARCH RE
7EEE FE22 QUEST	00650	CF	-	, 15 IIII A SDAKCII KE
7EFØ 28Ø2	00660	JR		;YES
7EF2 PE3A	00670	CP .	1:1	; IS THIS A PACKED SR
CH REQ	44444		g pene	. VPC
7EF4 CA8F7F	00680 PSRX: 00690	JP CP	Z,PSRCH	;YES ;IS THIS A REQ FOR T
7EF7 FE2E OP OF BUF	000 JU	CF	•	, to this h hay ton i
7EF9 28EØ	00700	JR	Z,MOVTP	
7EFB FE45	00710	CP	'E'	; IS THIS AN EDIT REQ
UEST				Listing continues



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Reviewed in March '82 "80 Microcomputing"

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Listing continued

ontinue	o .			
7E <b>P</b>	D 2002 F 23	00720 00722	JR INC	NZ, CHK2 ; CHECK FOR LIST REQ HL ; POINT TO NEXT CHARA
7F0	Ø 7E 1 FE3B 3 2859	00730 00740 CHK2: 00750	LD CP JR	A,(HL) ;LOAD 2ND BYTE ;; ;NEXT LINE REQ 2,FNXT ;YES, FIND CURRENT L
7F0 7F0 7F0	5 FECE 7 286A 9 FE40	00760 00770 00780	CP JR CP	<pre>ØCEH ;PREV LINE REQ Z,FPREV ;YES, FIND CUR LINE 'e' ;THIS LINE REQ (AT S</pre>
7F0	B 2803 D B7 E 2043	00790 00800 00810	JR OR JR	Z,BLDCM ;YES, BUILD CMD A ;THIS LINE REQ NZ,EXIT3 ;NOT A SHORT NOTAT
	Ø 3AE641	00820 BLDCM:	LD	A, (BUFAD) ; RESTORE 1ST CHARA
C 7F1	3 FE45	00830	CP	'E' ; WAS THIS A EDIT REQ
7F1 7F1 7F1 7F2 7F2 7F2 7F2 7F2 7F2	5 2804 7 3EB4 9 1802 B 3E9D D 21E641 0 77 1 23 2 3E2E 4 77 5 23 6 AF 77 78 C1	00840 00850 BLDC3: 00860 00870 BLDC4: 00890 00910 00910 00920 00930 00940 00950	JR LD JR LD LD LD INC LD	Z,BLDC4 ;YES SET TOKEN A,094H ;LIST TOKEN BLDC6 A,090H ;EDIT TOKEN HL,BUFAD ;BUFFER (HL),A ;STORE IT HL A,2EH ;THE PERIOD (HL),A ;STORE IT HL A ;LAST BYTE (HL),A BC ;RESTORE STACK
	9 ED4B3E4Ø		LD	BC, (PRVRQ) ; PREV REQUES
OR	D 2A2040	00980	LD	HL,(4020H) ;PROMPT CURS
7F3 7F3 7F3	10 37 11 3F 12 ED42 14 7C CREEN	00990 01000 01010 01020	SCF CCF SBC LD	HL,BC ;DECR CURSOR POS. A,H ;WAS DECR PAST START OF
7F3	35 FE3C 37 3803	01030 01040	CP JR	3CH C,NOINC ;DONT MOVE PAST STAR
	39 222040 3C 3AE641	01050 01060 NOINC:	LD LD	(4020H), HL ;STORE IT A, (BUFAD) ;SAVE COMMAN
7 F + 7 F +	BF 218000 A2 FEB4 B3 B3 B6 214000 B9 223E40 B0 010700 B1 E1 B1 F1 B2 C9	01070 01080 01090 01100 01110 EXITO: 01120 01130 EXIT1: 01140 01150 EXIT4:	LD CP JR LD LD LD POP POP POP RET	HL,080H; DEC FOR LIST 0B4H 2,EXIT0 HL,040H; DEC FOR EDIT (PRVRQ), HL ;STORE IT BC,7 ;SET CMD LENGTH HL ;RESTORE REGS DE AF; RETURN TO ROM PROCE
7F:	53 C1 54 18F9 56 ED5BEC40	01170 EXIT3: 01180 01190 FLINE:	POP JR LD	BC EXIT1 DE,(TLNO) ;FIND CURRENT LIN
7F	NO. 5A CD2C1B 5D C9	01200 01210	CALL RET	FLNO ;USE ROM ROUTINE
7F.	5E CD567F 61 CD667F 64 18AA	01220 FNXT: 01230 01240	CALL CALL JR	FLINE ;FIND CUR LINE LODLA ;INCR TO NEXT LINE BLDCM ;BUILD LIST OR EDIT
	66 7E	01250 LODLA:	LD	A, (HL) ; CHECK FOR END OF PR
76 76 76 76 76 76 76 76 76	67 23 68 B6 69 C8 6A 23 6B 4E 6C 23 6D 46 6E ED43EC40 72 C9	01260 01270 01280 01290 LODLN: 01300 LODLP: 01310 01320 01330 01340 01350 FPREV:	INC OR RET INC LD INC LD LD RET CALL	HL ; POINT TO LINE NO. (HL); END IF ZERO Z; END ENCOUNTERED HL C,(HL); LOAD LINE NO. HL B,(HL) (TLNO), BC; STORE IT FLINE; LOCATE CUR LINE
	76 2AA440		LD	HL, (BASPT) ; POINT TO BASIC
7F 7F 7F 7F 7F	79 EB 7A EB 7B 5E 7C 23 7D 56 7E 7A	01370 01380 FPRV1: 01390 01400 01410 01420 01430	EX EX LD INC LD LD SUB	DE,HL DE,HL E,(HL);LOAD POINTER HL D,(HL) A,D;COMPARE BC-DE B
7F 7F 7F 7F 7F C	7F 90 80 38F8 82 208C 84 7B 85 91 86 38F2 88 2086 OMMAND	01440 01450 01460 01470 01480 01490	JR JR LD SUB JR JR	C,FPRV1 NZ,BLDCM A,E C C,FPRV1 NZ,BLDCM;CANT FIND BUT SEND
	8A CC6A7F 8D 1881	01500 01510 01520 ;	CALL JR	Z,LODLN ;LOAD LINE NO BLDCM ;BUILD COMMAND
GT	VEN	01530 ; RO	UTINE TO	SEARCH BASIC PROG BUFFER FOR
01	- 21.	01540 ; CHA 01550 ;	ARAC STR	ING Listing continues

Listing cor	ntinued			
	7F8F 79 7F90 FE06 7F92 2053 7F94 CD567F	01560 PSRCH: 01570 01580 01590	LD CP JR CALL	A,C ; WAS STRING INPUT 6 NZ,LODBF ; YES LOAD BUFFER FLINE ; FIND CUR LINE
	7F97 E5	01600	PUSH	HL ; SAVE PTR
	7F98 181B 7F9A CD567F	01610 01620 PSRCX:	JR CALL	SRCHX ; CONT SEARCH FLINE ; FIND LOC OF CURRENT L
	INE			;BC POINTS TO CURREN
	T LINE	01630		
	XT LINE	01640		;HL POINTS TO THE NE
	7F9D E5	01650 SRCHA:	PUSH INC	HL ;SAVE POINTER BC ;SKIP PAST POINTER A
	7F9E 03 DDR	01660		•
	7F9F 03 7FA0 ED434140 LINE NO	01670 01680	INC LD	BC (LNPTR),BC ;SAVE POINTER TO
		01690		; FOR LATER USE ON
	MATCH 7FA4 Ø3	01700	INC	BC ; ADJUST FOR LINE NO
	7FA5 37 7FA6 ED42	01710 01720	SCF SBC	HL,BC ; NO. OF CHARAC IN TH
	IS LINE 7FA8 03	01730	INC	BC :PT TO START OF LINE TEXT
	7FA9 C5	01740	PUSH	BC ; EXCHANGE HL/BC
	7FAA ES	01750	PUSH	HL ; EXCHANGE HL/BC
	7FAB Cl 7FAC El	01760 01770	POP POP	BC HL ; RESTORE POINTER TO
	NEXT LINE 7FAD 114340	01780 SRCHK:	LD	DE.STRING : ADDR OF SEARCH S
	TRING 7FBØ 1A	01790	LD	A, (DE) ; LOAD FIRST CHARAC
	7FB1 EDB1 ARAC	01800	CPIR	; SEARCH FOR FIRST CH
	7FB3 280E 7FB5 E1	01810 01820 SRCHX:	JR POP	Z,SRCH2 ; MATCH FIRST CHARAC HL : RESTORE POINTER TO
	NEXT LINE 7FB6 E5	Ø183Ø	PUSH	HL
	7FB7 C1	01840	POP	ВС
	7FB8 5E 7FB9 23	01850 01860	LD INC	E,(HL) ;LOAD NEXT POINTER HL
	7FBA 56 7FBB EB	Ø1870 Ø1880	LD EX	D,(HL) DE,HL ;EXCHANGE REGS
	7FBC 7C	Ø1890	LD	A,H ; CHECK FOR END OF BU
	FFER 7FBD B5 7FBE 20DD	Ø19ØØ Ø191Ø	OR JR	L NZ,SRCHA; NO, CONTINUE SEARC
	H 7FCØ C3CCØ6	01920	JP	06CCH ; RETURN GO BASIC
	7FC3 3A4040 LENGTH	01930 SRCH2:	LD	A, (STRLN) ; LOAD STRING
	7FC6 B7 CHARAC	01940	OR	A ; IS STRING A SINGLE
	7FC7 28ØB 7FC9 47	01950 01960	JR LD	Z,SRCH4;YES B,A
	7FCA E5 7FCB 13	01970 01980 SRCH3:	PUSH INC	HL ;SAVE LINE POINTER DE ;GET NEXT CHARAC
	7FCC 1A	01990	LD	A, (DE)
	7FCD BE 7FCE 23	02000 02010	CP INC	(HL) HL
	7FCF 200D	62828	JR	NZ, SRCH6 ; CONT SEARCH
	7FD1 10F8 7FD3 E1	02030 02040	DJNZ POP	SRCH3 HL ; RESTORE STACK
	7FD4 E1 7FD5 2A4140	02050 SRCH4: 02060		HL HL,(LNPTR) ; LOAD LINE N
	O. 7FD8 CD6B7F	02070	CALL	LODLP
	7FDB C3177F	02080	JP	BLDC3 ; REQUST LIST
	7FDE E1 7FDF 0600	02090 SRCH6: 02100	POP LD	HL ; RESTORE POINTER B, Ø ; RESTORE COUNTER
	7FEL ØD 1 POS	02110	DEC	C ; MOVE SEARCH POINTER
	7FE2 28D1 7FE4 23	02120 02130	JR INC	Z,SRCHX;CONT SRCH HL;MOVE POINTER 1 POS
	7FE5 18C6	02140	JR	SRCHK ; CONT SRCH THIS LINE
			SEARCH S	TRING BUFFER
	7FE7 21E741	92179 ; 92186 LODBF:	LD	HL, BUFAD+1 ; POINT TO BU
	FFER 7FEA 0600	02190	LD	B,Ø ;CLEAR COUNTER
	7FEC 114340 BUFFER	02200	LD	DE, STRING ; PT TO SRCH
	7FEF 7E ER	02210 LOADB:		A,(HL) ; MOVE CHARAC TO BUFF
	7 <b>FF0</b> B7 7 <b>FF1</b> 2806	02220 02230	OR JR	A ; CHECK FOR END Z, LOADM
	7FF3 12 7FF4 84	02240 02250	LD INC	(DE),A ;STORE IT
	7FF5 23	02260	INC	HL ; PT TO NEXT CHARAC
	7FF6 13 HARAC	02270	INC	DE ; PT TO NEXT STRING C
	7FF7 18F6 7FF9 Ø5	02280 02290 LOADM:	JR DEC	LOADB ; LOOP TIL END B
	7FFA 78 7FFB 324040	02300 02310	LD LD	A,B ;STORE STRING LEN (STRLN),A
	7FFE 189A	02320	JR	PSRCX ; GO SEARCH
	7ECD 00000 TOTAL	02330 ERRORS	END	JEHMN2

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# Morse Code in color.

# CC CQ

Michael J. Chuck 648 Longmeadow Drive Severna Park, MD 21146

t was only a matter of time before I decided to merge my two hobbies—computers and amateur radio. The Radio Shack 16K Extended Basic Color Computer, well shielded against radio frequency interference, makes a very good candidate for a Morse code terminal.

My first step was defining the features I wanted in a Morse terminal. After studying many ads for Model I terminals, I came up with the following wish list for my system:

- Code speeds of 5-60 words per minute
- Automatic speed adjustment when receiving
- Split-screen operation
- Reasonably low cost

## The Key Box

Color Computer
Extended Color Basic
16K RAM
Amateur radio receiver
and transmitter

- Ability to compose messages while receiving
- Menu-driven transmit for pre-made messages
- Transmit buffer to allow typing ahead of the kever
- Automatic file handling of the QSO information
- Ability to update the current QSO file while receiving
- Morse code practice feature

After many program edits, the wish list finally became a reality and my Color Computer was operating on the air. I was so pleased with its performance that I decided to pass my ideas along to all you hams with Color Computers.

## System Description

Both the transmit and receive routines are written in Assembly language to take advantage of the higher speed of execution. The transmit portion of the program uses a look-up table to convert ASCII code to the dots and dashes of Morse code.

Since Morse consists of only dots and dashes, a binary number can represent the code sequence of a letter. The program uses one to represent a dash and zero to represent a dot. All code sequences must begin with one, however, to distinguish between letters that start with dots in Morse. For example, the letter S can be represented in a table by 00001000 and Z by 00011100. By performing successive left shifts on the binary value, the dots and dashes can be peeled off after locating the leading one.

The transmit table begins at hex 3B40, so by substituting the ASCII value of the letter to be transmitted for the least-significant byte (40) the decode address is formed. For example, the letter C is hex 43 in ASCII. Therefore, at address hex 3B43 the value 26 is stored (binary 00011010). After removing the leading one the code 1010 remains, so the letter C (dash dot dash dot) would be sent.

The actual keying is accomplished with the cassette motor control relay. By setting bit 3 at address FF21 (65313 decimal) the relay is energized. After waiting the appropriate time for a dot or dash, bit 3 is reset to deenergize the relay. The computer relay output at the cassette motor control plug is capable of using my Heathkit electronic keyer directly. If you attempt to key a transmitter directly, however, use a low-voltage isolation relay to protect the computer relay.

The receive portion of the program uses the serial I/O jack on the Color Computer to input Morse signals. If bit 1 at address 65314 is set, data is present on the data input line (pin 2 of the connector). However, the computer requires a signal greater than +3 volts. An inexpensive two-transistor amplifier boosts the receiver phone jack signal to a higher level. Since the amplifier actually supplies a pulsating dc voltage, a digital filter (time delay) was incorporated into the receive routine.

The purpose of the filter is to ensure that the computer disregards the highfrequency changes in the signal. A filter value of 30 is loaded initially. If on high-

40	Entry point of the transmit mode
90	Entry point of the message menu
110-300	Decode of the menu selection
310-400	Code practice generator section
410	Entry point of the receive mode
430-560	Store the transmit buffer and scanned file data when returning to the transmit mode
570-660	Calculate transmit speed factor and store
670-740	Preview canned messages prior to transmission
750-830	File update menu
840	Beginning of file-handling routine
	Table 1. HAMSHACK functional-block line numbers

speed receiving some letters are lost, you can relax the filter. Enter Delay from the menu, and then a new lower value. The filter should be as high as possible (less than 256) and yet receive properly.

Decoding data-present signals from Morse to ASCII uses the same technique as the transmit portion. After loading a leading one and shifting left, a zero is loaded if the data is present less than two dot times, and a one is loaded if the data is present for more than two dot times. A left shift is performed after each successive digit is loaded. During receive the dot time is dynamically adjusted. If data is not present for greater than two dot times, the letter is decoded and displayed on the upper portion of the screen.

The table for decoding received signals is located at address hex 3F00. For example, the letter A is loaded as 00000101 during receive (hex 05). By substituting into the table address, 3F05 becomes the decoder address. A PEEK to the decoder address will return the number 65, which is the value to be POKEd to video RAM to display the letter A.

Usage

QSO file storage

Receive routine

the keyboard)

selection)

Top of screen cursor counter

Timing counter storage

Name scan storage area

Call scan storage area

Remarks scan storage area

ASCII value of last key input

Storage position pointer for scan of remarks

Receive Morse to ASCII decoder table

Address

1536~3071

3098-3327

14653-15167

15168-15231

15233-15234

15235-15236

15237-15737

15738-15978

15981-15982

15983-15984

15985-15986

15987-15988

15990-15991

15992-15993

15994-15995

15996-15997

15998-15999

16002-16003

16004-16013

16014-16015

16016-16025

16026-16027

16028-16126

16127-16383

16000

transmit/receive switch and can be used to default to transmit mode from any menu. the message menu. The up arrow key is from 599 to the new numbers.

Also callable from the message menu are three utility functions:

- Speed allows entering a new transmit code speed
- Delay allows entering a new receive filter delay value
- Test sends random code for practice

The Basic calling program is completely menu driven. The enter key is used as the There are five message text buffers that can be pre-loaded and called up to transmit via used to enter the message menu from the transmit mode. Any message selected from the menu is displayed on the bottom portion of the screen for review before being transmitted. During review, if RST is to be sent, enter three numbers instead of a normal review reply to change the RST report

While in the transmit mode, the down arrow calls up the current QSO log menu. You can make changes in any field from this menu. After a QSO is completed it can be saved to page 1 of video RAM from this M6\$ (line 7) used to store the transmit text composed during the receive mode Transmit conversion table (ASCII to Morse) Value to POKE to 65313 to turn on cassette relay Two times the transmit speed dot time Seven times the transmit speed dot time (word spacing) Keyboard scan and character-handling subroutine M6\$ pointer (points to the next POKE position) "No data present" timer count on receive. Transmit pointer on transmit (points to posi tion of next letter position on the bottom of screen to be transmitted) Transmit buffer cursor counter (position on bottom of screen to display next letter from Value to POKE 65313 to turn off cassette relay Six times the receive dot time (used for word space) Four times the receive dot time (used as dash compare for automatic speed adjustment) Two times the received dot time (used for dot/dash selection and for element/character Receive dot time (used for automatic speed adjustment) Received letter decoder value (value to display) Storage position pointer for scan of his name Storage position pointer for scan of his call

Table 2. Memory use

#### During transmit

- 1-Call the message menu
- +-Call the current QSO file update menu
- #-Send AR
- @ Send a string of dots (error)
- & Send SK

Enter-Switch to the receive mode

#### **During** receive

- t-Start scanning his name
- +-Start scanning his call sign
- →—Start scanning his QTH

Clear-Stop the scanning process Enter-Switch to the transmit mode

Table 3. Key functions

menu also. Depending on the amount of data in each field of the file, 15 to 30 files can be saved to RAM before taping and clearing the storage area.

From the file update menu, reviews, tape saves, verifies and more can be done. A verify must always be performed after a tape save to clear the file storage area. (Be sure to replace the cassette motor control plug into the cassette and remove this program before tape saves.)

File data is saved to tape as a string with field separators as follows:

```
STRING$ = "<" + T0$ + "%" + T1$ + "%" + FQ$ + "%"
        HC$ + "%" + HN$ + "%" + QT$ + ">"
    T0$ = QSO start time
    T1$ = QSO finish time
    FQ$ = Frequency used
    HC$ = His call sign (station worked)
    HN$ = His name
    QT$ = His QTH and other remarks
```

By performing string searches for the separators, the file data can be recovered. (How about a program to check for duplicate QSOs during a contest, or to print the log? The log data is all available on tape, so let your imagination go and program your computer to do a little more of your work.)

To ease data entry into the log and the canned messages, three arrow keys can be pressed during receive to scan and file data as it is displayed. The other ham's call, name and remarks can be scanned by pressing ↓, ↑, → respectively. The received video will be displayed in the inverse mode to verify what is scanned. Pressing clear stops the scan. Scanning erases any data that was in the scanned field of the log from a previous receive mode, but it is cumulative during a given receive mode until returning to the transmit mode. For example, the QTH could be scanned and the scanning stopped. Later during the same receive mode, his rig description may be scanned into the same file field.

While in the receive mode, a message can be composed on the bottom of the screen. Since this message is POKEd directly into M6\$ (line 7 of the program), you must keep the text in the correct area. Backspacing beyond the start position (print position 288) or entering characters beyond the end of screen can destroy the Basic program. The technique of POKEing directly to a string constant proved to be the fastest

method of handling the message when returning to the transmit mode.

One of the five message buffer numbers may be selected for the text when returning to transmit. If none is selected (you press only enter) buffer 1 is used. Because of this default, message 1 should not be filled when starting the program if you plan to prepare text while receiving. You may, however, change any message during program execution by typing during receive and

(RS #276-1604) Transistor 2N3906 Transistor 2N3904 (RS #276-1603) Diode 1N914 (RS #276-1620) LED and holder (BS #276-068) Capacitor .01uf (RS #272-131) Resistor 10K ohms (RS #271-034) Resistor 5.6K ohms (RS #271-031) (RS #271-017) Resistor 330 ohms (RS #271-023) Resistor 1K ohms (RS #275-602) Power switch (RS #40-245) Speaker 2" (RS #26-3020) DIN Plug Phone plug 1/4 " (RS #42-2377) Phone jack 1/4 ' (RS #274-255) Mini box (RS #270-251) Component board (RS #276-160) 9 volt battery (RS #23-464) Battery holder (RS #270-326) (RS #270-325) Battery clip

Table 4. Parts list

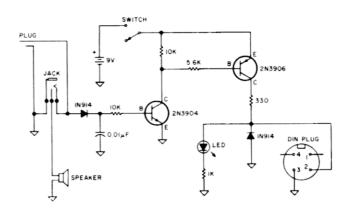


Fig. 1. Schematic diagram (see Table 4)

specifying the appropriate buffer number to store the text in.

If the radio receiver is inactive, press enter to return to the transmit mode. After a minute or two in the receive mode with no activity, the automatic speed compensation software may not recover properly. This is not a problem because the transmit mode is the desired standby mode. From transmit the menu calls are available and pressing enter immediately switches to the receive mode.

During transmit a wraparound buffer (the bottom portion of the screen) is used

for typing. As the program sends a character it clears it from the bottom buffer and displays it on the top of the screen. This allows the typing to be more than 200 characters ahead of the transmitter. The buffer turned out to be a real plus for a moderate typist working at five-words-perminute code speed!

### The Interface Amplifier

Since the audio signal of my radio receiver was too low to be detected by the RS-232 input, a simple amplifier was required. I decided on a very simple circuit us-

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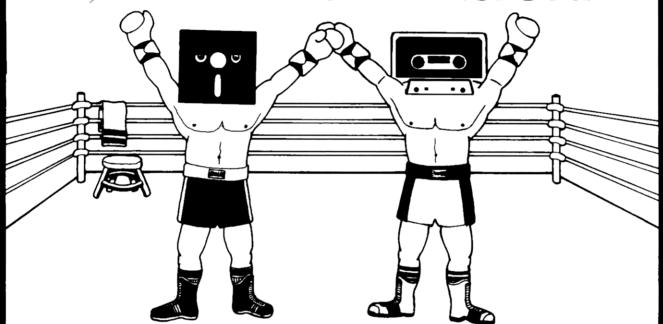


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**-** 10.

ing parts available from the local Radio Shack store.

The two-transistor circuit rectifies and produces a positive output voltage whenever a tone is present at the radio receiver earphone jack. An LED gives a visual indication that the proper level of output voltage is being supplied to the computer. In operation the receiver gain is adjusted to a level to activate the LED as no gain control was placed in the interface amplifier circuit.

Figure 1 shows the schematic for the circuit. Table 4 lists the components required. I used a general-purpose circuit board and just started soldering. Layout is not critical. If you can read a simple schematic and do a little soldering, you will have no trouble with the interface.

#### **Program Entry**

Since QSO logs are saved in page 1 of the video RAM, always perform a PCLEAR1 when turning on your computer. Hamload (Program Listing 1) is run prior to Hamshack (Program Listing 2) to load the transmit and receive routines. Since Hamload contains all of the Assembly-language data, it is a bit tedious to key in. Be patient! Errors in data statements are difficult to find and have disastrous results.

I wrote Hamshack in a packed form to conserve memory, so it is also a bit tedious.

When keying it in, enter lines 5 and 7 exactly as listed! The receive routine POKEs directly to M6\$ and adding a space or changing a line number to two digits will cause problems.

Some user-specific information must be inserted in lines 130, 140 and 160. Also, there is room for two additional messages in the message menu. By studying lines

110-190, the addition should be self-explanatory.

If some day you hear KA9EQD calling CQ, please give me a call. My Color Computer has been dying to talk to one of his own kind!

Michael Chuck, a mechanical engineer, enjoys amateur radio and model rail-roading.

## Program Listing 1

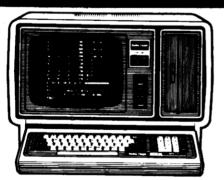
10 CLS:PRINT ASSEMBLY LANGUAGE LOADER :CLEAR 10,14650:FORK=15237T O15978: READ A: POKE K, A: PRINT@256, K, A: NEXTK 20 FORK=15979T016127:POKE K,0:PRINT@256,K,0:NEXTK 30 FORK=16157TO16382:POKE K,0:PRINT@256,K,0:NEXTK 40 FORK=16128TO16157:READ A:POKEK, A:PRINT@256, K, A:NEXTK:POKE1616 0,53:POKE16161,52:POKE16163,51:POKE16167,50:POKE16168,43:POKE161 70,35:POKE16175,49:POKE16176,54:POKE16177,45:POKE16178,47:POKE16 184,55:POKE16188,56:POKE16190,57:POKE16191,48:POKE16197,38 50 FORK=14653TO15231:READA:POKEK,A:PRINT@256,K,A:NEXTK 60 POKE16204,63:POKE16213,46:POKE16234,59:POKE16237,40:POKE16243 ,44:POKE16248,58:POKE16383,0:CLS:PRINT\*LOAD AND RUN hamshack\*:EN 70 DATA252,62,111,131,0,30,46,18,252,62,111,243,62,126,253,62,12 6,204,0,0,253,62,111,126,59,247,182,62,128,72,183,62,128,126,60, 60,204,0,0,253,62,111,126,60,188 80 DATA204,12,26,253,62,109,204,5,32,253,62,113,204,4,0,253,62,1 15,134,0,183,62,129,204,62,132,253,62,130,204,62,144,253,62,142, 204,62,156,253 90 DATA62,154,182,255,34,129,6,38,42,134,1,183,62,128,204,0,0,25 3,62,111,253,62,126,182,255,34,129,6,38,35,252,62,126,195,0,1,25 3,62,126

Listing continues

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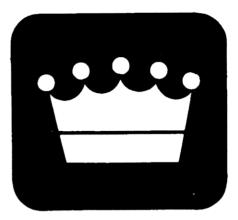
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**~**254

100 DATA189,61,122,182,62,128,182,62,128,126,59,240,189,61,122,1 82,62,129,129,13,38,1,57,126,59,219,182,255,34,129,7,38,23,252,6 2,111,195,0,1 110 DATA253,62,111,189,61,122,182,62,129,129,13,38,1,57,126,60,2 6,126,59,133,18,252,62,126,179,62,122,45,8,182,62,128,139,1,183, 62,128,252,62,126 120 DATA179,62,124,46,24,252,62,126,253,62,124,243,62,126,253,62,122,243,62,122,253,62,120,243,62,122,253,62,118,252,62,126,179, 62,120,45,43,252,62,126 130 DATA253,62,120,182,62,120,68,183,62,122,182,62,121,70,183,62 ,123,182,62,122,68,183,62,124,182,62,123,70,183,62,125,252,62,12 0,243,62,122,253,62,118 140 DATA252,62,111,179,62,122,45,3,126,60,182,204,0,0,253,62,126 ,253,62,111,126,59,240,204,0,0,253,62,126,182,62,128,183,60,196, 182,63,0 150 DATA183.62.128,182,62,129,129,94,39,26,129,10,39,49,129,9,39,72,182,62,128,128,64,46,8,182,62,128,139,64,183,62,128,126,61,6 5,252,62,130 160 DATA253.60,255,195,0,1,16,131,62,142,39,3,253,62,130,182,62, 128,183,0,0,126,61,55,252,62,142,253,61,26,195,0,1,16,131,62,154 ,39,3 170 DATA253,62,142,182,62,128,183,0,0,126,61,55,252,62,154,253,6 1,53,195,0,1,16,131,63,0,39,3,253,62,154,182,62,128,183,0,0,182, 62,128 180 DATA128,64,45,3,183,62,128,252,62,115,253,61,90,195,0,1,16,1 31,5,0,38,3,204,4,0,253,62,115,182,62,128,183,0,0,252,62,111 190 DATA179,62,118,46,14,204,0,0,253,62,111,134,1,183,62,128,126 59,240,134,1,183,62,128,126,59,169 200 DATA189,161,193,129,0,39,8,183,62,129,18,18,126,61,189,182,6 2,129,129,0,39,42,129,94,39,19,129,10,39,17,129,9,39,15,129,13,3 9,41 210 DATA129,12,39,14,126,61,232,30,137,30,137,30,137,30,137,126, 61,212,134,0,183,62,129,126,61,212,204,0,1,30,137,30,137,30,137, 30,137,18 220 DATA126,61,212,252,62,109,253,61,210,134,62,183,0,0,30,137,3 0,137,30,137,30,137,30,137,30,137,30,137,204,0,1,30,137,57,129,8 ,39,79,128,64 230 DATA45,37,252,62,109,253,62,12,195,0,1,253,62,109,252,62,113,253,62,15,195,0,1,253,62,113,182,62,129,183,0,0,183,0,0,18,126, 62,101 240 DATA252,62,109,253,62,49,195,0,1,253,62,109,252,62,113,253,6 2,54,195,0,1,253,62,113,182,62,129,183,0,0,139,64,183,0,0,126,62 250 DATA252,62,109,131,0,1,253,62,77,195,0,0,253,62,109,134,32,1 83,0,0,252,62,113,131,0,1,253,62,97,195,0,0,253,62,113,134,96,18 3,0,0 260 DATA18,18,134,0,183,62,129,57 270 DATA0.32.69,84,73,65,78,77,83,85,82,87,68,75,71,79,72,86,70, 0,76,0,80,74,66,88,67,89,90,81 280 DATA204,12,126,253,62,109,182,62,114,177,62,112,39,57,182,62 ,112,183,57,105,183,57,97,139,1,129,255,38,2,134,32,183,62,112,1 82,5,0,183,62,130,134,96,183,5,0 DATA182,62,116,183,57,128,139,1,129,255,38,2,134,0,183,62,11 6,182,62,130,183,4,0,126,57,166,189,61,122,182,62,129,129,13,39, 23,129,10 300 DATA39,19,129,94,39,15,182,62,114,129,255,38,5,134,32,183,62,114,126,57,61,57,182,62,130,183,57,174,182,59,0,183,62,130,120, 62,130,37,76,120,62,130,37,84,120,62,130,37,92 310 DATA120,62,130,37,100,120,62,130,37,108,120,62,130,37,116,12 0,62,130,37,124,204,0,0,195,0,1,253,62,126,189,61,122,182,62,129 ,129,94,39,14,182,62,114,129,255,38,5,134,32,183,62,114,32,1,57, 252,62,126,16,179,59,131,38,216,126,57,61 320 DATA120,62,130,37,5,189,58,205,32,3,189,58,148,120,62,130,37 ,5,189,58,205,32,3,189,58,148,120,62,130,37,5,189,58,205,32,3,18 330 DATA120,62,130,37,5,189,58,205,32,3,189,58,148,120,62,130,37 ,5,189,58,205,32,3,189,58,148,120,62,130,37,5,189,58,205,32,3,18 ,58,148 340 DATA120,62,130,37,5,189,58,205,32,3,189,58,148,204,0,0,195,0 ,1,253,62,126,189,61,122,182,62,129,129,13,39,22,129,10,39,18,12 9,94,39,14,182,62,114,129,255,38,5,134,32,183,62,114,32,1,57,252 ,62,126,16,179,59,129,38,208,126,57,61,182,59,128,183,255,33 350 DATA204,0,0,195,0,1,253,62,126,189,61,122,182,62,129,129,13, 39,22,129,10,39,18,129,94,39,14,182,62,114,129,255,38,5,134,32,1 83,62,114,32,1,57,252,62,126,16,179,59,129,38,208,182,59,128,183,255,33,204,0,0,195,0,1,253,62,126,189,61,122,182,62,129,129 360 DATA13,39,22,129,10,39,18,129,94,39,14,182,62,114,129,255,38,5,134,32,183,62,114,32,1,57,252,62,126,16,179,62,107,38,208,182 62,117,183,255,33,204,0,0 370 DATA195,0,1,253,62,126,189,61,122,182,62,129,129,13,39,22,12 7,10,39,18,129,94,39,14,182,62,114,129,255,38,5,134,32,183,62,11 4,32,1,57,252,62,126,16,179,62,107,38,208,57 380 DATA128,5,24,26,12,2,18,14,16,4,23,13,20,7,6,15,22,29,10,8,3,9,17,11,25,27,28,0,0,0,0,0,0,0,85,0,42,0,0,69,0,109,109,109,0,40,115, 49,85,50,63,47,39,35,33,32,48,56,60,62,120,106,0,0,0,76 390 END



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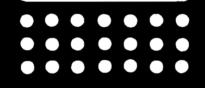
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#### Program Listing 2

```
10 CLS:INPUT"WPM"; S:GOSUB570:CLS:K=PEEK(65313):POKE15989,K:S=K O
18 CLS:INPUT"MPM";S:GUSUB578:CLS:K=PEEK(65313);PUKE15989,K:S=K U
R 8:POKE15232,S:RS$="599";R4=1536:DEFUSR1=15282:DEFUSR2=14653
28 INPUT"YOUR CALL";CS$:CLS:GOSUB1220:PRINT"MESSAGE #1";:PRINT@6
6,"";:INPUTM1$:CLS:GOSUB1220:PRINT"#2";:PRINT@66,"";:INPUTM2$:CL
S:GOSUB1220:PRINT"#3";:PRINT@66,"";:INPUTM3$:CLS:GOSUB1220:PRINT
"#4";:PRINT@66,"";:INPUTM4$:CLS:GOSUB1220:PRINT"#5";
30 PRINT@66,"";:INPUTM5$:CLS:POKE15985,5:POKE15986,32
 40 POKE16001,0:PRINT@256, "TRANSMIT MODE";:GOSUB680:POKE15987,4:P
OKE15988,0:POKE15983,5:POKE15984,32
50 K=USR2(0)
60 K=PEEK(15989):POKE65313,K
 70 IF PEEK(16001)=10 GOTO750
80 IF PEEK(16001)=13 GOTO410
 90 GOSUB670: POKE15985,5: POKE15986,32
100 PRINT@265, "MESSAGE MENU": PRINT: PRINT"CQ
                                                                          CALL OTH
                                                                                             RIG
  OVER
              NAME RST
                                          ORM
                                 73
                                                    ANS
                                 TEST
                                         DELAY SPEED": INPUT"SELECT"; A$
110 IFAS="CQ" THEN XS="CQ CQ CQ DE "+CSS+" K ":GOTO690"
120 IFAS="CALL" THEN XS=HCS+" "+HCS+" DE "+CSS+" KN ":GOTO690"
110 IFAS="CALL" THEN XS=HCS+" "+HCS+" DE "+CSS+" KN ":GOTO690
120 IFAS="CTH" THEN XS="CTH QTH ENTER YOUR QTH HERE !":GOTO690
130 IFAS="QTH" THEN XS="CTH QTH ENTER YOUR RIG HERE -":GOTO6
130 IFA$="QTH" THEN X$="QTH QTH ENTER YOUR QTH HERE !":GOTO690
140 IFA$="RIG" THEN X$="RIG HR 15 ENTER YOUR RIG HERE -":GOTO690
150 IFA$="OVER" THEN X$="BK TO U "+HC$+" DE "+C$$+" KN ":GOTO690
160 IFA$="NAME" THEN X$="NAME IS ENTER YOUR NAME -":GOTO690
170 IFA$="RST" THEN X$="RST RST "+R$$+" "+R$$+" - ":GOTO690
180 IFA$="73" THEN X$="73 TO U AND URS "+HN$+". HP TO WK U AGN S
CON. DE "+C$$+" K ":GOTO690
190 IFAS="QRM" THEN XS="QRM QRM PSE TRY AGN. DE "+CSS+" KN ":GOT
0690
200 IFAS="1" THEN X$=M1$:GOTO690
210 IFAS="2" THEN XS=M2$:GOTO690
220 IFAS="3" THEN X$=M3$:GOTO690
 230 IFAS="4" THEN X$=M4$:GOTO690
240 IFAS="5" THEN X$=M5$:GOTO690
250 IFA$="ANS" THEN X$=HC$+" DE "+C$$+" R R - OK ON LAST XMIT "+
HN$+" - ":GOTO690
 270 IFAS="SPEED" THEN GOSUB670:PRINT@256, "NEW WPM";:INPUTS:GOSUB
570:GOSUB670:GOTO40
280 IFAS="DELAY" THEN GOSUB670:PRINT@256, "NEW FILTER DELAY";:INP
UTK:IFK<256 THEN POKE15242, K:GOSUB670:GOTO40 ELSE PRINT"VALUE TO
O LARGE":FORK=1 TO 100:NEXTK:GOTO280
290 IFAS="TEST" GOTO310
300 GOSUB670:GOTO40
310 X$="":FORKK=1TO30:FORJJ=1TO5
320 K=RND(47)+40:IFK=41 THEN K=35
330 IFK=42 THEN K=38
340 IFK=43 THEN K=40
350 IFK>59 AND K<63 THEN GOTO320
360 X$=X$+CHR$(K)
370 NEXTJJ
380 X$=X$+" "
390 NEXTKK
400 A$="S":GOTO710
410 CLS:PRINT@256, "RECEIVE MODE":PRINT@0, "";:POKE15996,0
420 K=USR1(0):CLS:K=PEEK(15982)-26
430 M7$=LEFT$(M6$,K)
440 INPUT"BUFFER NUMBER (1-5)"; K:ON K GOTO450,460,470,480,490
450 M1$=M7$:GOTO500
460 M2$=M7$:GOTO500
470 M3$=M7$:GOTO500
480 M4$=M7$:GOTO500
490 M5S=M7S
500 IFPEEK(16003)=132 GOTO520
510 HN$="":FORK=132TO PEEK(16003):L=PEEK(15872+K):HN$=HN$+CHR$(L):NEXTK:IF RIGHT$(HN$,1)=" THEN K=LEN(HN$)-1:HN$=LEPT$(HN$,K)
520 IFPEEK(16015)=144 GOTO540
530 HC$="":FORK=144TO PEEK(16015):L=PEEK(15872+K):HC$=HC$+CHR$(L):NEXTK:IF RIGHT$(HC$,1)="" THEN K=LEN(HC$)-1:HC$=LEFT$(HC$,K)
540 IFPEEK(16027)=156 GOTO560
550 QT$="":FORK=156TO PEEK(16027):L=PEEK(15872+K):QT$=QT$+CHR$(L):NEXTK:IF RIGHT$(QT$,1)=" THEN K=LEN(QT$)-1:QT$=LEFT$(QT$,K)
560 CLS:POKE15985,5:POKE15986,32:GOTO40
570 IFS<7.4 THEN S=150+31.25*(7.4-S):GOTO660
580 IFS<9.6 THEN S=115+15.9091*(9.6-S):GOTO660
590 IFS<13 THEN S=85+8.8235*(13-S):GOTO660
600 IFS<16.8 THEN S=65+5.2632*(16.8-S):GOTO660
610 IFS<22 THEN S=50+2.8846*(22-S):GOTO660
```

Listing continues

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The UPI interfaces are completely self contained and ready to use. A 34 conductor cable and connector plugs onto the parallel printer port of the Model I expansion interface or onto the parallel printer port on the back of Models II and III. A DB25 socket mates with the cable from your serial printer. The UPI interfaces convert the parallel output of the TRS-80 printer port into serial data in both the RS232-C and 20 MA. loop formats.

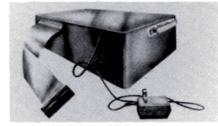


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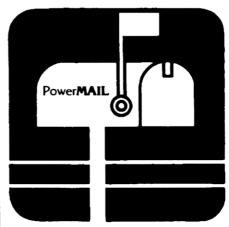
- Linefeed after Carriage Return
- Handshake polarity (RS232-C)
- Nulls after Carriage Return
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- 1 or 2 Stop Bits per word
- Parity or no parity
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```
Listing continued
620 IFS<27.2 THEN S=40+1.9231*(27.2-S):GOTO660
630 IFS<36 THEN S=30+1.1364*(36-S):GOTO660
640 IFS<54 THEN S=20+.5556*(54-S):GOTO660
650 S=53:GOTO640
660 JJ=INT(S/256):KK=S-JJ*256:POKE15979,JJ:POKE15980,KK:K=2*S:JJ
=INT(K/256):KK=K-JJ*256:POKE15233,JJ:POKE15234,KK:K=6.5*S:JJ=INT
(K/256): KK=K-JJ*256: POKE15235, JJ: POKE15236, KK: RETURN
670 PRINTe256,STRING$(255," "):RETURN
680 PRINTe0,STRING$(255," "):PRINTe0,"";:PETURN
690 GOSUB670: PRINT@256, XS: PRINT@480, "S=SEND MESSAGE "; CHR$(94);
 "=MENU";:INPUTA$:GOSUB680
700 IFAS=CHR$(94) GOTO90
710 IFAS="S" THEN GOSUB670:PRINT@288,X$;:K=LEN(X$)+32:POKE15986,
K: GOTO40
730 IF LEFT$(X$,3)="RST" THEN RS$=A$:X$="RST RST "+RS$+" "+RS$+"
   ": GOTO6 9Ø
740 GOSUB670:GOTO40
750 POKE15985,5:POKE15986,32:GOSUB670:PRINT@265, "UPDATE MENU":PRINT"C= ";HC$;:PRINT TAB(15) "N= ";HN$:PRINT"F= ";FQ$;:PRINT TAB(15) "X=START= ";T0$:PRINT"?= ";QT$:PRINT"S=SAVE":INPUT"SELECT";X$
760 IFXS="C" THEN GOSUB670: PRINT@256, "CALL="; HC$: INPUT ENTER HIS
 CALL"; HC$: GOTO750
770 IFX$="N" THEN GOSUB670:PRINT@256,"NAME=";HN$:INPUT"ENTER HIS
NAME"; HNS:GOTO750
780 IFXS="F" THEN GOSUB670: PRINT@256, "FREQ="; FQS: INPUT ENTER THE
 FREQ";FQ$:GOTO750
790 IFX$="X" THEN GOSUB670:PRINT@256, "START TIME="; TO$:INPUT"ENT
ER THE START TIME"; TØ$:GOTO750
800 IFX$="/" OR X$="?" THEN GOSUB670:PRINT@256, "REMARKS=";QT$:IN
PUT"ENTER REMARKS (QTH)";QT$:GOTO750
810 IFX$=CHR$(94) GOTO90
830 IFX$<>"S" THEN GOSUB670:GOTO40
840 GOSUB670: PRINT@256, ENTER THE STOP TIME ;: INPUTT1$: GOSUB670
850 PRINT@265, "FILE MENU":PRINT"T=TAPE ALL FILES":PRINT"S=SAVE C URRENT FILE TO RAM":PRINT"V=VERIFY TAPE DATA":PRINT"R=REVIEW FILES":PRINT"Q=RETURN TO FILE DATA":INPUT"SELECT";X$
870 IFX$="T" GOTO920
880 IFX$="S" GOTO950
890 IFX$="V" GOTO980
900 IFX$="R" GOTO1050
910 GOSUB670:GOTO40
920 GOSUB670:PRINT0256, "SET CASSETTE TO RECORD":INPUT PRESS ENTE R"; A$:OPEN "O", #-1, "FILE"
930 FORKK=1536TO3071:PRINT #-1,PEEK(KK):NEXT
940 CLOSE #-1:GOTO750
950 XS="<"+T0$+"%"+T1$+"%"+FQ$+"%"+HC$+"%"+HN$+"%"+QT$+">":AL=30
71-R4:LS=LEN(X$):IFLS>AL THEN GOSUB670:PRINT0256, "NO ROOM LEFT!"
:FORKK=1TO3000:NEXTKK:GOTO750
960 FORKK=1 TO LS:A$=MID$(X$,KK,1):JJ=ASC(A$):POKE R4-1+KK,JJ:NE
XTKK
970 R4=R4+LS:HC$="":HN$="":QT$="":T0$=T1$:RS$="599":GOTO750
980 ON ERROR GOTO1030:GOSUB670:PRINT0256, "SET CASSETTE TO PLAY":
INPUT"PRESS ENTER";A$:OPEN "I", #-1, "FILE"
990 ON ERROR GOTO1040:FORKK=1536TO3071:INPUT #-1,K:IFK<>PEEK(KK)
 THEN PRINT"ERROR"
1000 NEXTKK:INPUT"CHECK COMPLETE PRESS ENTER"; A$
1010 INPUT"CLEAR FILE (Y/N)"; A$: IF A$="Y" THEN R4=1536:FORKK=153
6 TO 3071: POKE KK, 0: NEXTKK
1020 CLOSE #-1:GOTO750
1030 PRINT"ERROR": FORKK=1T03000: NEXT: GOTO750
1040 PRINT"ERROR": NEXTKK
1050 W2=1536
1060 KK=0:F0$="":F1$="":F2$="":F3$="":F4$="":F5$=""
1076 JJ=PEEK(W2):IFJJ=62 GOTO1180
1080 IFJJ=37 THEN KK=KK+1:GOTO1160
1090 IFJJ=60 GOTO1160
1100 IFKK=0 THEN F0$=F0$+CHR$(JJ)
1110 IFKK=1 THEN F1$=F1$+CHR$(JJ)
1120 IFKK=2 THEN F2$=F2$+CHR$(JJ)
1130 IFKK=3 THEN F3$=F3$+CHR$(JJ)
1140 IFKK=4 THEN F4$=F4$+CHR$(JJ)
1150 IFKK=5 THEN F5$=F5$+CHR$(JJ)
1160 W2=W2+1:IFW2>R4 GOTO750
1170 GOTO1070
1180 W2=W2+1:GOSUB670:PRINT@266,"FILE REVIEW":PRINT"C=";F3$;:PRI
NT TAB(15) "N=";F4$:PRINT"F=";F2$;:PRINT TAB(15) "X=";F0$;" ";F1
$:PRINT"?=",F5$:INPUT"Q=QUIT P=PROCEED";X$
1190 IFX$="Q" GOTO750
1200 IFX$="P" GOTO1060
1210 GOTO1180
1220 PRINT@32,STRING$(32,"-"):PRINT@256,STRING$(32,"-"):PRINT@0,
 ";:RETURN
```



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1230 END

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Pascal-80 is not "just another compiler" but an honest attempt to provide TRS-80 users with a meaningful system for this language. It is a monitor system that provides an interface to the disk-file structure, a text editor, the Pascal compiler, and the Pascal interpreter. The system comes on a TDOS (tiny version of DOSPLUS) system disk in single-density, 35-track format for Model I users.

Users are not limited to this operating system; they can use Pascal-80 with any of the second-generation operating systems, such as NEWDOS80.

#### **Operation**

The system is easy to operate; you type the command Pascal from the DOS-ready prompt and follow the displayed command menu.

All the system functions of Pascal-80 are available from the monitor, making it easy to save and load files, compile, execute, and edit source text from the monitor. The compiler/editor system uses an in-memory text buffer with 23K of memory space that holds about 1,100 lines of code. The amount of source code that can be stored increases with use of text-compression techniques. Mr. Blank (one of the program's modifiers) has provided an Include compiletime option that lets you assemble a library of routines on the disk and compile only those routines you need by including them in your source program. This lets you create source programs of a size limited only by your system's memory capacity.

The in-memory compile feature also accounts for the compiler's incredible speed. When timed on a Model I running at standard speed (1.77 MHz), I got compile rates averaging 1,000 lines per minute when listing to the video screen and 1,500 lines per minute using the NOLIST option.

The system has some nice features available from the monitor to aid the user: The W command lets you write the compiled P-code to disk in a named file, and the X command lets you execute this compiled code directly from disk. This allows you to compile lengthy programs once in the final version and then run them directly without compilation delays. In addition, when executing the compiled code from the disk, you gain an additional 9K of memory, as the whole system,

except the P-code interpreter, is overlayed by the compiled object code.

#### Pascal-80 Editor

The Pascal-80 system has a full-screen editor that you can invoke from the monitor. Text displays on the video screen in a moving window of 15-line groups. By pressing the break key, the editor command menu displays at the bottom of the screen.

The editor uses a blinking underline character (the normal cursor character) that moves by pressing the arrow keys. Unlike many text editors, each line is a separate entity and cannot be extended past 64 characters. The text lines are stored in the text workspace only after pressing enter. This includes updating any changes made to the line after it is originally typed. As with all the keys, the arrow keys auto-repeat to move the cursor as far as you want. If you try to pass the upper or lower boundaries of the video screen, it will scroll in that direction for as long as you press the respective arrow key.

Cursor movement using the arrow keys is usually nondestructive; however, you can correct errors by backspacing over them using shift, left arrow. Or, you can use the text-overwrite mode and just type over the line. Remember, you must press enter to save any line changes.

The editor command menu gives a listing of the commands for editing the source program. Invoke each command by using the control key, shift, down arrow. This is a change from the original Pascal-80 that used break to preface all editor commands. Break now writes an editor command menu on the bottom line of the screen where

it remains until you exit the editor or press clear.

The workspace stores the text using a text-compression algorithm that encodes one or more blank spaces into one byte. This produces a significant file-size reduction, but this file format is not compatible with any text editor currently in use. The logical length of each line, including encoded blanks, is always 64 bytes and the individual lines are not separated by an end-of-line character (0DH). Even though the revised editor available with Pascal-80 includes many of the necessary functions to efficiently edit text, it is still convenient to use a full text editor in many cases. Mr. Blank has provided conversion programs to convert text files to ASCII files and vice-versa.

## Pascal-80 Compiler

The next major component in the Pascal-80 system is the compiler. This compiler generates a pseudo-code (commonly called a P-code) output in a one-pass compilation process. The P-code must be interpreted in order to be meaningful. The concept is based on compilers being able to operate on different machines and produce code that was transportable from one installation to the next. The P-code generated by Pascal-80 is not true P-code, but a compressed output requiring less space.

There are six compiler options to divert compiler output from the video screen to the line printer and to control information regarding the stack space, symbol table space, and actual code generated. The compiler output can be suppressed except for error messages. Two options allow all variables to be preset to zero upon allocation and perform a verify operation after disk file writes.

The compiler implements a TRS-80 version of the standard Pascal with some limitations and extensions. The reference manual with Pascal-80 does not describe the Pascal language and I suggest you buy *Programming in Pascal* by Peter Grogono (Revised Edition, Reading, MA Addison-Wesley, 1980) as a tutorial on the standard language. The following standard Pascal functions are *not* currently implemented in Pascal-80:

- Variant records, which record definitions that use the Case...Of variant structure to define multiple structures on the same data record.
- The With...Do statement.
- Pointer variables, including the New and Dispose statements.
- File window (buffer) variables, in-

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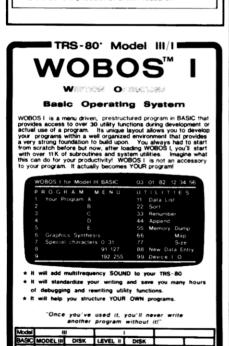
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					Tiny	Pascal		
Test No.	Benchmark Test	Pascal-80	Disk Basic	Fortran-IV	P-Code	Z80		
1	FOR/DO LOOP	0.503ms	1.872ms	0.071ms	0.942ms	0.444ms		
2	A = 1.0	0.885ms	10.582ms 10.214msx	0.549ms 0.289msx				
3	1X = 1	0.460ms	3.192ms	0.019ms	0.249ms	0.107ms		
4	$\mathbf{A} = \mathbf{A} + 1.0$	4.084ms	14.191ms 12.454msx	3.194ms 0.904msx				
5	IX = IX + 1	0.956ms	4.723ms	0.039ms	0.557ms	0.162ms		
6	IARRAY(I) = 0	2.743ms	11.142ms	0.066ms	0.456ms	0.213ms		
7	J = K x L	1.937ms	6.041ms	0.582ms	0.804ms	0.517ms		
. 8	$\mathbf{A} = \mathbf{B} \mathbf{x} \mathbf{C}$	9.979ms	11.206ms 6.438msx					
9	POKE White Out	1.24sec	7.24sec	0.122sec +	1.33sec	0.70sec		
- 10	SET White Out	9.47sec	44.53sec		17.75sec	6.97sec		

Table 1. Benchmark Comparisons. The For... Do loop benchmark test was timed for 10,000 executions of the loop and the times displayed are the average values for one execution of the loop. Each of the benchmark times are listed in milliseconds, unless otherwise noted. For each of tests 2–8, the statement listed was timed for 10,000 executions in a For... Do loop and the average execution time for the statement is calculated from the difference in execution times for the For... Do loop with and without the statement. The tests were run in single- and double-precision floating-point arithmetic using Basic and Fortran to demonstrate the speed difference in the two arithmetic modes. Pascal-80 uses only the double-precision (14 digits) mode.

- The time listed is for execution of the statement using single-precision floating point values
- This method executed so fast that it was necessary to time the execution of the program for an average over 100 executions.

cluding the Get and Put procedures.

- The procedures Pack and Unpack (all structures are already based on allocation on byte boundaries).
- The Page procedure (but Write (LP,CHR(12)) is a good substitute).
- File structures (i.e., Array of File). Sets are limited to 256 members, and if numeric, the set members must be in the range of 0-255. The identifier of a procedure or a function cannot be passed as a parameter to another pro-

cedure or function. No expression passed as a value parameter can exceed 510 bytes unless passed as a VAR parameter. Integer variables used to reference array elements in a record must be global variables. Local variables will not work.

The character [ can be replaced with (. and ] replaced with .) on the Model I. The Model III has these characters and generates them on the display. Even though the Model I user will see the

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characters as up arrow and left arrow respectively, these characters will still compile and print correctly. Spaces are significant in some isolated Pascal-80 situations where they would not be significant in standard Pascal. Mr. Blank is currently working on a release to implement these features.

Many extensions have been added to this newer version of Pascal-80 and are listed below.

- Arrays of characters can now be printed with a single statement.
- The Read and Write procedures can now be used with nontext files in place of the Get and Put procedures.
- When using string constants in assignment statements and in comparisons with character arrays, the constant on the right can be shorter than the item on the left and will be padded with blanks as necessary. If String is type ARRAY[1..10] OF CHAR then STRING: = 'NAME' is valid and STRING>'NA' is True. (The right argument must have at least two characters to be a string and not a CHAR.)
- PROC and FUNC are abbreviations for the keywords procedure and function.
- Predefined constants are MININT (-32,768), MAXINT (32,767), PI, true, and false.
- Real variables have 14 digits of precision and occupy eight bytes. The data type REAL6 is provided if this much significance is not needed and occupies four bytes. You save no time as all calculations are done in double precision. REAL6 variables cannot be passed to a procedure or function as a value parameter unless they are members of an array or record.
- No files need be declared in the program header. In addition, the program name is optional. There are three default files (INPUT, OUTPUT, LP) that are declared as File of Text.

The following procedures have been added to the standard Pascal procedures/functions:

- ◆ Call (address,value)—a type integer function that places the eight-bit value in the A register and calls the routine located at address. The eight-bit value in the A register on return is the function value.
- Close—closes disk files
- CLS—clears the screen
- EX (real-expression)—a type integer function that returns the exponent value of the real-expression.
- FP (real-expression)—a type real function that returns the mantissa of the real-expression as its function value.
- INKEY—a function returning the

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**SRT**—Sorts one or more arrays into a specified sequence

FMT—Arranges data into a string variable as with PRINT USING

PDAT/UDAT\$—Permits user to do arithmetic on dates.

**PK\$/UPK\$**—Compresses strings to save disk space. **ETIM\$**—Shows the difference between two times.

CLEAR—Specifies the number of file blocks to be allocated when

you specify high memory and string space.

**DELETE**—Allows you to dynamically remove portions of a BASIC program.

In addition to these, there are functions unique to Model II and to Model III. The exclusives to Model II are long error messages and PEEK/POKE. The exclusives to Model III are:

SWAP—Supports exchange of variables with a single statement.

**HEX\$**—Converts numbers to hexadecimal strings.

**RESTORE**—Allows you to set READ pointer to location of choice.

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value of the keyboard at the call in CHAR format. This function is identical to the Basic INKEY\$ function.

- MEM—an integer function that returns a value corresponding to the amount of memory remaining.
- PEEK (address)—an integer function that returns the eight-bit value from memory at address.
- POKE (address, value)—normally. this is a procedure to place the eight-bit value at the address specified; however, the procedure has been extended. The address and value parameters are interpreted as the x and y coordinates of the graphic pixel, and if address is in the range of 0-127, then a Set operation is performed. If address ranges from 128-255, then a Reset is performed, and if address is in the range of 256 to 383, then a Point is performed with the result left in location 21458 that can be accessed with a PEEK (0 if the point is off and nonzero otherwise).
- Seek (expression, file name)—positions the specified file name to the record in the file pointed to by the integer value of expression.

A compile-time function is recognized to let you include source code from a disk file in the program current-

ly being compiled. This is done by placing the compiler command (\*\$ file name \*) in the source program where the included code is to be inserted from the disk. This is a powerful addition to the original Pascal-80. The Case statement has two extensions from standard Pascal. An optional Else clause will be executed if no other case condition is satisfied, and if no satisfied case condition and no Else clause exists, execution passes to the next statement without generating an error message.

Both integer and real values are displayed using the same format descriptors, for example, Write (expression: fieldwidth:digits). A field width of zero produces a display in the default format for the displayed expression type. Similarly, a field width of -1 produces the display of the expression in scientific notation.

In addition to the functions specified as part of the standard Pascal language and the extensions just covered, Mr. Blank has added the functions for random numbers. The Basic functions of RND(0) and RND(number) are coded in Pascal to provide linkage to the runtime package and are stored on the system disk so they can be included in any program. The POKE command ac-

cesses the graphic capability of the TRS-80.

Pascal-80 provides an additional source-code procedure (GOTOXY) on disk to let you position the video system cursor to any screen location. The call GOTOXY (horizontal-pos, vertical-pos) specifies the cursor's location.

#### **Additional Features**

The Pascal-80 master disk contains the compiler system and several other files. These files contain the Pascal source code for graphics, randomnumber, and GOTOXY linkages, plus several demonstration Pascal programs. Each program is designed to illustrate a feature of the Pascal language.

In addition to the demonstration programs, there are two utilities to convert Pascal-80 text files to ASCII character files (ASCII/CMD) and to convert from character format files to text format (TEXT/CMD). The ASCII files can be used with almost any word processor. I have had no problem using Newscript to read the files, but Electric Pencil needs a 00H byte at the current end-of-file prior to reading it with Pencil.

The two remaining files (AU-THOR/SRC and AUTHCODE/ CMD) allow you to write an application program in Pascal, compile it and sell it as a CMD file that executes directly from the disk operating system command level. New Classics Software grants a license to original registered owners of Pascal-80 to distribute programs compiled by Pascal-80, provided you meet the requirements specified in the user's manual. A minimal program (BEGIN END.) compiled and converted to a CMD file requires nine granules of disk space due to the P-code's interpreter.

## Pascal-80's Performance

I performed benchmark comparisons using similar programs written in Pascal-80, Disk Basic, and Fortran. Table 1 reports the results of the comparisons. The first eight tests were conducted using a simple For-loop executed 10,000 times. After determining the time for the For-loop, the times for each of the remaining tests were calculated. Test number 9 is a simple For-loop to white out the video screen by POKEing the value 191 (BFH) from locations 15360 to 16383. Test number 10 is a nested For-loop to white out the video screen by use of the Set(x,y) command.

Pascal-80's performance is out-



standing considering the interpretive nature of its execution. From observing the data in test 8 (and similar data for the computation A = B + C), it is obvious that the 14-digit precision of Pascal-80's floating-point arithmetic can make the program almost as slow as an identical Basic program if using extensive floating-point arithmetic. However, the converse statement that single-precision Basic can run faster is not necessarily true and you'll have to use many floating-point calculations to overcome the strength of the compiled source program.

The data in tests two and four show that the Basic times are only slightly different and both single- and double-precision calculations are significantly slower than the corresponding double-precision statement executed in Pascal-80. This is because Basic must interpret each component of each statement every time it is executed and each constant must be converted from character format to binary every time encountered. Basic is spending most of its time in the conversion routines.

The initial benchmark comparison yielded a surprise when test 10 was timed. Pascal-80 was slower than Basic for the screen white-out using the Set command. This was due to the addition of the graphics commands as an afterthought and the use of Pascal-80 as a software linkage to these high-performance routines. I immediately received an upgraded system implementing these commands as a special option of the POKE statement.

The comparison to Tiny Pascal was included to demonstrate that the far more complex implementation of Pascal-80 does not suffer from a slow-down caused by size growth. Remember, Tiny Pascal is only a very limited subset of the total language.

#### Conclusion

I have tried to portray Pascal-80 as the first real attempt to provide useful implementation of TRS-80 Pascal for a reasonable price. You should be using a Z80 compiler such as Fortran if speed is your major objective. But if ease in programming using this well-structured language is your objective, then Pascal-80 is perfect.

The ability to write, edit, compile, and debug your program in a friendly, interactive environment is a great instructional tool.

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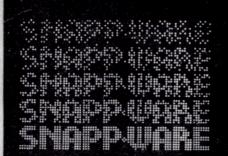
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# TRS-80 Tongues

by Robert Nicholas and Philip Martel

an't decide which language to use? Here's a simple temperature conversion program in six: Basic, Fortran, Cobol, Pascal, APL, and Forth.

Why buy another language when you already have Basic in your TRS-80? It all depends on what you want your programs to do. Let's consider six languages from the perspective of one simple problem—a Fahrenheit-to-Celsius conversion. The examples will give you a feel for the languages' similarities and differences.

#### Basic

Nearly every home computer comes with Basic (beginners' all-purpose sym-

bolic instruction code) built-in. The average newcomer to computing can sit down with an introductory manual and begin writing simple programs in Basic within a few hours. Power!

Basic is rather forgiving, and more or less conversational. While the more powerful commands of a modern extended Basic appear strange, the core commands of the language are everyday words: GOTO, Return, If, Then, Else, And, Or, Let, Input, Print, Random, Read, Write, Run, Stop, New, +, -, \*

(multiply), and / (divide).

For instance, look at Program Listing 1. This routine accepts a temperature in Fahrenheit degrees and converts it to Celsius via the formula C = 5/9 (F -32).

The first three program lines are remark statements, indicated by the Basic command REM. The programmer uses these lines as notes—they don't mean anything to the computer.

The CLS in line 40 tells the computer to clear the screen.

Line 50 tells the computer to print the phrase "Degrees Fahrenheit" at position 256 on the screen. (The TRS-80 has 1,024 positions on the screen, broken down into 16 lines of 64 characters.)

Line 60 waits for you to enter the degrees in Fahrenheit you want converted to Celsius. Your entry will be stored in the computer as the variable F.

Line 70 provides a means of escaping the program. If you enter the number -9999.99, the program ends. If the value of F is anything other than -9999.99, the program continues with line 80, which clears the screen again.

The Key Box

Model I or III Programming Languages

```
10 REM BASIC PROGRAM TO CONVERT FAHRENHEIT TO CELSIUS
20 REM BOB NICHOLAS
30 REM ENTERING A VALUE OF -9999.99 ENDS THE PROGRAM
40 CLS
50 PRINT@ 256, "DEGREES FAHRENHEIT ";
60 INPUT F
70 IF F = -9999.99 THEN END
80 CLS
90 C = (F - 32) * 5/9
100 PRINT@ 384, F; " DEGREES FAHRENHEIT = "; C; " DEGREES
CELSIUS"
110 GOTO 50
```

Program Listing 1. Basic Version

Line 90 calculates the Celsius equivalent to F.

Now line 100 prints your value and the Celsius value on the screen at position 384. Line 110 tells the computer to go to line 50, where the program asks you for another Fahrenheit value to convert.

You can enter whole numbers, decimal numbers, and positive and negative numbers into this program. All we said was Input F—we didn't have to specify that F could be either positive or negative, or how many decimal places we were going to use. Well, that's not true of all computer languages.

#### **Fortran**

Fortran, an acronym for formula translation, is similar to Basic. However, the input and output from Fortran generally require Format statements (something like Basic's Print Using). In addition, while Basic is usually interpreted, Fortran is almost always compiled. A compiled program runs faster than one that is interpreted.

Lines 100 and 200 (see Listing 2) start with a C. They are comments—remarks.

Lines 300 and 400 display "Type in Fahrenheit Value" on the screen. The first column holds Editor line numbers, not used by the Fortran program. To the right are Fortran line numbers, and they may be referred to in the program. Line 300 says write to the screen (logical unit number—LUN1) what's in line 15. Line 400 gives directions to skip a line (/), write the text in single quotes, and skip another line.

Lines 500 and 700 cause the program to read the value F from the keyboard (which is also referred to by the LUN 1) in a format (F15.0) that allows, but does not require, a decimal point. Line 600 goes to line 40 if F is less than (.LT.)-500. It could have been put after line 700, but we wanted to show the format statement separated from the I/O statement.

One style of Fortran programming places all format statements at the end of the program. This is useful if a particular format is used many times; it can be written once and found easily.

Line 800 is the actual computation. Notice the decimal points. The distinction between integers and real numbers is much stronger in Fortran than in Basic. If you want a constant treated as a real number, you have to put in the decimal point.

Real numbers, as a computer thinks of them, are numbers that can have fractional parts. Integers do not have fractional parts. In Basic, if you want to

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```
00100
          PROGRAM TO CONVERT FAHRENHEIT TO CELSIUS
00200
       C
          BY PHIL MARTEL
00300
       1 a
                WRITE(1,15)
00400
                FORMAT(/' TYPE IN THE FAHRENHEIT VALUE'/)
00500
                READ(1,20) F
00600
                IF (F .LT. -500.) GOTO 200
00700
                FORMAT(F15.0)
       20
aasaa
                C=5./9.*(F-32.)
                WRITE(1,30)F,C
00900
01000
                FORMAT(1x,G10.3,' DEGREES FAHRENHEIT IS '
       30
01100
            1 ,G10.3,' DEGREES CELSIUS')
01200
                GOTO 10
01300
       200
                STOP DONE
01400
                END
                   Program Listing 2. Fortran Version
```

```
000100 IDENTIFICATION DIVISION
000110 PROGRAM-ID.
                        FAHRENHEIT.
000120 AUTHOR.
                         BOB NICHOLAS.
000130************
000140*
         THIS PROGRAM ACCEPTS A TEMPERATURE IN FAHRENHEIT *
000150*
         DEGREES FROM -9999.98 TO 9999.99 AND CONVERTS IT
000160*
         TO CELSIUS DEGREES.
000170*
         A VALUE OF -9999.99 ENDS THE PROGRAM.
000180*****
000190
000200 ENVIRONMENT DIVISION,
000210
       CONFIGURATION SECTION.
000220 SOURCE-COMPUTER.
                             TRS80-I
000230 OBJECT-COMPUTER.
                             TRSRØ-I.
000240
000250 DATA DIVISION.
000260
       WORKING-STORAGE SECTION.
           FAHRENHEIT
000270
       77
                        PIC S9(4) V99.
000280
       77
77
            CELSIUS
                         PIC 59(4) V99.
000290
            OUESTION
                         PIC ZZZ9.99-.
000300 77
            ANSWER
                         PIC ZZZ9-99-
000310
000320 PROCEDURE DIVISION.
000330 10-MAINLINE.
000340 DISPLAY "
                        ERASE.
000350
              PERFORM
                      20-CONVERSION
                                         UNTIL
                                                  FAHRENHEIT
-9999.99.
000360
            STOP RUN.
000370
000380
       20-CONVERSION.
            DISPLAY "DEGREES FAHRENHEIT" LINE 5 POSITION 2.
000390
            ACCEPT FAHRENHEIT LINE 5 POSITION 28
000400
000410
                SIZE 8 PROMPT CONVERT
000420
            COMPUTE CELSIUS = FAHRENHEIT - 32) * 5 / 9.
000430
            MOVE FAHRENHEIT TO QUESTION.
            MOVE CELSIUS TO ANSWER.
000440
            DISPLAY QUESTION LINE 07 POSITION 02 ERASE,
000450
                  DEGREES FAHRENHEIT = ",
NSWER, " DEGREES CELSIUS".
000460
000470
                ANSWER,
000480 END PROGRAM.
                    Program Listing 3. Cobol Version
```

use integers you have to use DEFINT or place a % after the variable name. In Fortran, a variable that starts with the letters I through N or a number without a decimal point is assumed to be an integer.

Line 900 outputs the Fahrenheit and Celsius values. Line 1000 is the Format statement for line 900. The 1X specifies that the first character is a blank. This is needed because the first character output is a printer control character. Certain nonblanks can produce odd results. The G10.3 outputs a number with 10

spaces allocated, up to three of which are after the decimal point.

Line 1100 is a continuation of line 1000. The & in column 6 indicates a continued line. Anything but a zero or blank will do.

Line 1300 stops execution of the program, prints Stop Done and returns to DOS. Line 1400 tells the compiler to stop. Unlike Basic, where an End statement can occur anywhere, in Fortran an End must only be the last statement in the program.

#### Cobol

Cobol (common business-oriented language) programs tend to be lengthy. The language demands a certain amount of structure—every Cobol program (see Listing 3) consists of four blocks referred to as divisions. These are: Identification division (lines 100–180); Environment division (lines 200–230); Data division (lines 250–300); and Procedure division (lines 320–480).

The Identification division indicates the name of the program (line 110) and the author (line 120). You can also indicate the date the program was written and the date it was compiled. Generally, the only thing required by Cobol is the Program ID. Each of these lines is referred to as a "paragraph."

I ines 130-180 are remarks, indicated to the editor by an asterisk in the first column following the line number. As in Fortran, the line numbers are for editing purposes only. Notice also that lines (sentences) end in periods.

The Environment division is broken down into sections. The Configuration section is broken down into two paragraphs that record the source computer (the computer on which the program is to be compiled) and the object computer (the computer on which the program will be run). In addition, if the program contains any files to be processed, they must be spelled out in the Input/Output section.

The Data division is broken down into three possible sections: File section, Working-storage section and Linkage section. Only the Working-storage section appears in this program. Every variable used in the execution of the program must be specifically mentioned in one of these three sections. If the variable is one of the fields in a file, it would appear in the File section. If it is a nonfile variable used in the process of executing the program, it would be in the Working-storage section. And if this were a subroutine called from another computer program, the variables being passed back and forth would have to be in the Linkage section.

This may seem tedious compared to the convenience of Basic, but it provides the programmer far greater control over the information being processed. Additionally, whereas Basic variables can be two characters long and Fortran variables can be six, Cobol variables can be up to 30 characters long. This makes reading and editing Cobol programs easier.

In this program, we have four variables defined in the Working-storage

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```
(* 10*)(* FAHRENHEIT TO CELSIUS CONVERSION IN TINY PASCAL
(* 20*)(* BY PHIL MARTEL *)
(* 30*) VAR F,C,CINT,CFRAC,FLAG : INTEGER;
(* 40*) BEGIN
(* 50*)
           FLAG := 1;
(* 60*)
           WHILE FLAG =1 DO
(* 70*)
           BEGIN
(* 80*)
              WRITE('TEMPERATURE IN FAHRENHEIT');
(*90*)
              READ(F*);
IF F<= -500 THEN FLAG := 0
   100*)
  110*)
              ELSE BEGIN
(* 120*)
                 C := (F-32)*5;
(* 130*)
                 CINT := C DIV 9;
(*140*)
                 CFRAC := (ABS(C) MOD 9) *10 DIV 9;
(* 150*)
                 WRITE(F#, 'DEGREES FAHRENHEIT IS
CINT#,'.',CFRAC#,
* 160*)

* 170*)

END (* FOR THE CASE WHERE F > -500 *)
(*160*)
(* 170*)
(* 180*)
            END (* OF THE WHILE LOOP *)
(* 190*) END.
                    Program Listing 4. Pascal Version
```

```
Ø:
        CLS
        # 28 31
1:
Ø:
        FTOC
1:
        CLS
2:
        BEGIN
                 : 'ENTER DEGREES FAHRENHEIT ';
3:
4:
        CLS
        C \leftarrow (F - 32) \times 5 \% 9
5:
        F ; DEGREES FAHRENHEIT = ';C ; DEGREES CELSIUS'
6:
                   Program Listing 5. APL Version
```

section: Fahrenheit, Celsius, Question, and Answer. The 77 in front of them is a level number. The 77 level can appear in either the Working-storage or Linkage sections. It is used for variables that are not subdivided. Subdivision is one of the main advantages of Cobol. It provides the programmer with easy reference to a variable and to any predefined subsections of it. A subdivision is shown by a 01 level number with sublevels. For instance:

```
01 NAME.

03 LAST-NAME PIC X(15).

03 FIRST-NAME PIC X(12).

03 INITIAL PIC X(1).
```

This gives us a 28-character field called Name, a 15-character field called Last Name, a 12-character First Name and a one-character middle Initial. The X(15) specifies a field that will accept all keyboard characters. A() is used to specify alphabetic characters only, while 9() specifies numeric only.

Fahrenheit has a picture of S9(4)V99. The S means the value can be negative. If the S is left off, -25 and 25 both become positive 25. The 9(4) means that up to four digits may follow. V is an as-

sumed decimal point. And the 99 allows up to two digits following the decimal point. The result is that Fahrenheit must be between -9999.99 and 9999.99. If you enter 25, the V assumed decimal point will convert it to 25.00.

Celsius has a similar picture. Fahrenheit and Celsius must have assumed decimal points (the V) because they are used in calculations. However, when we want to show these values on the screen or on paper, we have to include the decimal point in the picture. Hence, we have two new variables.

Question will be used in printing the value entered for Fahrenheit. The picture clause is ZZZ9.99-. The Zs suppress leading zeros in the answer so that 0003.45 appears as 3.45. The dash means that we will have any negative sign printed after the number (3.45-).

Answer has a similar picture and is used in printing the value of Celsius on the screen. All these pictures are the equivalent of the Format statements in Fortran.

It is not at all unusual for the Data division to be the longest part of a Cobol program. Every variable used has to be carefully and explicitly defined.

Suppose we want to express the

equivalent of our Cobol line 270 FAHRENHEIT PIC S9(4)V99 in Basic. This would require the following additions to our Basic program following line 60 INPUT F:

```
61 IF F < -9999.99 OR
F > 9999.99 THEN GOTO 60
62 LET X = INT (X * 100) / 100
```

Line 61 assures us that F is within the proper range. Lines 62 and 63 detect if there are more than two digits following the decimal point. If there are, they get knocked off. And even this doesn't finish the task. Remember that if we enter 25 for the value of Fahrenheit, we will get 25.00. The Basic program would still print plain old 25. If we wanted the decimal format, we would have to use a Print Using statement in Basic. So if you are looking for this type of control in a business or commercial application, Cobol is by far preferable to Basic.

And finally, on to the Procedure division—the part of the program that actually does something. The Procedure division is broken down into paragraphs. This program contains two paragraphs in this division: 10-MAINLINE and 20-CONVERSION. All lines in a paragraph must be indented at least four spaces. Further indentation (such as lines 410, 460, and 470) is optional and strongly recommended.

While Cobol is a fairly standardized language, those commands relating to screen output tend to vary from computer to computer and compiler to compiler. As a result, some references within the Procedure division detract from the normal high degree of readability of the language. For instance, line 340 DISPLAY "" ERASE is the equivalent of CLS in Basic—it clears the screen.

If you glance through the rest of the Procedure division, you will notice there are no GOTOs even though they are available in Cobol. Good Cobol tends to be GOTOless programming. The program is written as a series of modules organized into paragraphs or sections made up of paragraphs. When you need to use a given module, you perform it, as in line 350.

PERFORM 20-CONVERSION UNTIL FAHRENHEIT = -9999.99.

Paragraph 20-Conversion will run continually (like a subroutine) until we enter -9999.99 as the value of Fahrenheit. Then execution drops to line 360, and the program stops. Note that in Cobol we perform or GOTO paragraphs rather than line numbers as in Basic. Big

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deal? You bet! How many times have you gone crazy trying to find the line number for your Basic subroutine or GOTO after renumbering a program? This problem doesn't exist in Cobol.

Now for the conversion and display portion of the program—line 390 prints Degrees Fahrenheit on the screen. Note that you get to state the screen position as a line number and position (column) number—much easier to locate than the Basic PRINT@ value.

Lines 400 and 410 are the equivalent of Input F. Note again that we get to state the screen position for the input. We set a size of eight, because our picture for Fahrenheit in Data division allows eight positions: one for the sign, four digits, a decimal point, and two more digits. The word Prompt tells the computer to put hyphens on the screen showing how many places are available for data entry (————). Finally, Convert tells the computer to store whatever is entered on the screen (string information) in Fahrenheit as a numeric value.

Line 420 does the actual conversion from Fahrenheit to Celsius. We Compute the value of Celsius.

Line 430 moves the value stored in Fahrenheit into Question for printout on the screen with the assumed decimal point in Fahrenheit (line 270) shown as indicated in the picture of Question (line 290). Line 440 does the same thing for Celsius.

Lines 450-470 format the screen printout of the input and the answer. Notice again that we get to specify the line and the position. The Erase statement clears the screen before the response is printed.

Line 480 (End Program) is required by the Cobol compiler, like Fortran.

#### Pascal

Radio Shack's Tiny Pascal lacks many features of a full Pascal, especially in the variety of data types—files, records, pointers, real numbers, and user-defined types. These data types are not needed, but they are a convenience and make programs more self-documenting. We used the method described in John Harrell's article "Modifying Tiny Pascal for Disk" (80 Micro, June 1981, p. 154) to put the Tiny Pascal system and source programs onto disk.

Pascal, unlike Basic or Radio Shack's Fortran, does not use line numbers. As a convenience, we have put numbers in comments (\*like this\*) at the beginning of each line.

Tiny Pascal compiles into an intermediate code called P-code, which is then interpreted. But for all practical purposes it is a compiler like Fortran.

Lines 10 and 20 (see Program Listing 4) are comments. The variables are defined in line 30. In Pascal, all variables must be defined at the start of the program or subroutine where they are used. This makes you more aware of the variables you are using and also allows the compiler to run faster.

Line 40 starts a block. All Pascal programs are composed of blocks, each of which begins with Begin and ends with (you guessed it) End. The main block ends at line 150. The period after End at line 150 tells the compiler it is the end of the program.

Line 50 sets the variable Flag for the While loop in line 60. While Flag equals one, it repeats the block in lines 70–180.

Line 80 asks for the Fahrenheit temperature and line 90 reads it in. The #in line 80 tells the system the input will be a decimal integer.

Line 100 tests the Fahrenheit value to see if it is less than or equal to -500. If it is, the flag is set to zero to end the While loop. If not, then the block in lines 110–170 is entered.

Lines 120-140 calculate CINT, the integer part of the temperature, and CFRAC, one digit after the decimal point. Lines 150 and 160 print the results. Again, # indicates that a decimal integer should be printed. The 13 at the

end does not have a #, so it is treated as a character, in fact a carriage return.

#### **APL**

APL (a programming language) is quite different from all the other languages discussed in this article. For one thing, it is essentially mathematical. Where most languages work with one-dimensional values (scalars), APL can deal with multidimensional blocks of data (matrices) just as handily.

APL does not use standard algebraic notation for its calculations—there is no hierarchy of operations as in algebra. A mathematical expression is simply evaluated from right to left. You can force order if you wish by using parentheses. The reason for this unusual feature is that APL has many operators besides the usual +, -, \*, and / of Basic or Fortran. Defining a reasonable hierarchy and keeping track of it would be very difficult, so Dr. Iverson, the developer of APL, avoided the issue.

Another major difference lies in the structure of a program. APL deals with a workspace rather than a program. Each workspace is composed of labeled functions that call one another as required. You execute one function from another merely by naming it.

For instance, in the APL workspace shown in Program Listing 5, we have two functions: CLS and FTOC. We initially enter the workspace through FTOC. The first thing FTOC does is execute the CLS function.

The CLS function has one command: #2831. The #is the equivalent of CHR\$ in Basic, so this line performs CHR\$(28) and then CHR\$(31)—it homes the cursor to the upper left corner of the screen and clears the screen from the cursor to the end. The result is a completely cleared video screen.

This brings us back to line 2 of FTOC. We label this line as Begin (we will want to come back to this spot later in the program) and then print "Enter Degrees Fahrenheit." (Note that you don't have to say Print. All output goes to the screen by default.)

Look at line 3. The small letter q stands for the APL command Quad. This equivalent of the Basic command Input is for numeric input only. Quote Quad is used for entering string information. In APL, line 3 would be phrased as ASSIGN F QUAD. (Assign—shown by the back arrow—is the equivalent of the equals sign in Basic.) You aren't limited to just typing in a number in APL. You could enter a mathematical expression (such as 5 + 3) or even a variable name (C, for example).

```
0 ( FAHRENHEIT TO CELSIUS CONVERSION PROGRAMS)

1 : FC 32 - 50 * 9 / ; ( REPLACES F WITH 10 * C )

2 : FTOC DUP . " DEGREES FAHRENHEIT IS "

3    FC DUP ABS <# # 46 HOLD #S SIGN #> TYPE

4    " DEGREES CELSIUS ";

5 : FCPROG BEGIN CR " TYPE IN FAHRENHEIT VALUE " CR #IN

6    FTOC 0 END;

7

8

10

11

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13

14

Program Listing 6. Forth Version
```

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#### **Forth**

Forth is an abbreviation for Fourthgeneration language. However, the second-generation system on which it was originally written only allowed fivecharacter program names. Hence, Fourth became Forth!

Forth is different. On the positive side, you are almost forced to write structured code in Forth. Forth is extensible. If you need a feature (say the arctangent of the ratio of two numbers) you can add it. The feature is then as much a part of the language as any other word.

On the negative side, writing a program in Forth is different than writing a program in Basic, Fortran, Cobol or Pascal, and is more like APL. You must learn the jargon.

As it comes out of the box, Forth does not support floating-point numbers, although you can add that capability.

Forth is a stack-oriented language. This means arithmetic statements are in

Reverse Polish Notation (RPN)—the system used by Hewlett-Packard calculators and internally by almost all computers. Numbers are entered onto a stack (the HP calculators have an enter button; Forth just requires a space) and then operations are performed on the numbers on the stack. For instance, 1 + 2 \* 3 would be written 1 2 3 \* + in Forth.

In Program Listing 6 line 0 is a comment. Comments in Forth are enclosed in parentheses. Note the word programs—there are three programs in this block: FC, FTOC, and FCPROG. (A block in Forth is very much like a workspace in APL.)

Line 1 is the definition of FC. Colons start a definition, and semicolons end it. FC starts with a Fahrenheit value on the operand stack, pushes 32 onto the stack, subtracts the top of stack (TOS) from the next value down, pushes 50 onto the stack, and so on. As the comment says, 10 times the Celsius value is left on the stack.

As I mentioned before, Forth uses integer arithmetic. Unless you use a floating-point or multiple-precision package, numbers are limited to the range 32767 to -32768. As the program is written, the Fahrenheit value must be

less than 656 degrees. With a larger value, the multiplication by 50 will overflow.

However, a built-in operator (\*/) performs a multiply followed by a divide. The results of the multiplication are double precision. Using this operator would allow temperatures up to 5,930 degrees Fahrenheit to be converted.

Lines 2, 3 and 4 define a program, FTOC, that prints "Degrees Fahrenheit Is," takes the number on the stack and converts it using FC, and prints the result and then "Degrees Celsius." The code in line 3 between the words DUP and TYPE outputs the number as a signed number with one decimal place.

Lines 5 and 6 define the third program, FCPROG. This is the outer program—it runs an endless loop with the BEGIN and O END, asks "Type in Fahrenheit Value," inputs the value, and calls FTOC, which does the conversion and outputs the result.

Robert Nicholas (2-B Lennox Heights, Lenox, MA 01240) runs a data-processing center. Philip Martel, an electrical engineer, can be reached at 748 Tyler St., Pittsfield, MA 01201.

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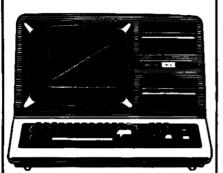
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# Grandpa ''Spooled'' His Computer

Tom Shield 40 Lake Park Road Champaign, IL 61820

ost large computers operate on a time sharing basis; the computer does a little of each of the many tasks it has to do at a time so that it can process all the tasks at the same time. Many peripherals are slower than the CPU itself; items such as terminals, printers and card readers run much slower than the CPU can drive them. The CPU can service each peripheral and complete many other tasks before servicing the peripheral again. There is no need for time sharing to allow many users on a TRS-80, since most of us have only one terminal, but most of us do have a printer and need a spooler.

Many spooling methods store the data quickly and then print the data while the CPU is doing other tasks. One method involves an extra CPU and memory. A second method, which I will present, involves using the computer's memory together with an interrupt routine to send characters to the printer. Both methods have advantages and disadvantages. The hardware method is invisible to the user and leaves all the machine's memory free, but at a prohibitive price. The second choice, a software spooler, is not invisible to the user and, depending on the buffer size, can drastically decrease available memory. On the other hand, it is less expen-

sive. Thus the software solution is the choice of most small system users.

#### Operation

Spooling requires two separate actions—storing the data and then sending it to the printer intermittently so the computer can do other tasks. The information must be intercepted before it is sent to the printer. The Model III PRCHAR (003BH) routine jumps out into RAM at 4025H and finds a JP 03C2H instruction returning it to ROM. It

Is simple to change this to the address of my storage routine. At the point the routine jumps to RAM, the character to be printed is in the C register and the registers are saved on the stack in the order HL,DE,IX,HL,BC (the first is an extra to balance the stack). I save the contents of the C register, POP the saved registers off the stack, and return to the calling program.

The Z80's first maskable interrupt causes a jump to 38H in the ROM and disassembly shows a subsequent jump to RAM at

#### Program Listing 1

ROUTINE TO DUMP BUFFER TO PRINTER BY A USR CALL

FD70	F3				DI	
FD71	21	C2	03		LD	HL.O3C2H
FD74	22	26	40		LD	(4026H),HL
FD77	ΕD	4B	FC	FD	LD	BC, (FDFCH)
FD7B	2A	FE	FD		LD	HL. (FDFEH)
FD7E	7E				LD	A. (HL)
FD7F	CD	3B	00		CALL	003BH
FD82	23				INC	HL
FD83	CD	<b>8</b> D	02		CALL	O2BDH
FD86	C2	60	FE		JP	NZ.FE60H
FD89	E5				PUSH	HL
FD8A	ED	42			SBC	HL, BC
FD8C	E1				POP	HL
FD8D	C2	7E	FD		JP	NZ.FD7EH
FD90	CD	50	FE		CALL	FE50H
FD93	21	AO	FD		LD	HL, FDAOH
FD96	22	26	40		LD	(4026H), HL
FD99	FB				ΕI	,
FD9A	C9				RET	
FD9B-FD	9F		00			NOP

- 'DISABLE INTERRUPTS
  'REPLACE JUMP TO STORE'ROUTINE TO DISABLE SPOOLER
  'GET END POINTER
- 'GET BEGINNING POINTER
  'GET CHARACTER FROM BUFFER
  'PRINT IT
- 'POINT TO NEXT ONE
- 'IF BREAK EXIT
  'SAVE CURRENT LOCATION
  'CHECK FOR END
- 'CHECK FOR END
  'RESTORE CURRENT LOCATION
  'LOOP IF NOT DONE
  'RESET POINTERS
- 'STORE ROUTINE ADDRESS
  'CHANGE PRCHAR JUMP
  'ENABLE INTERRUPTS
  'RETURN TO CALLER

Listing continues



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4012H. There a JP 3018H instruction takes the program back into ROM. I inserted a routine with a simple change in this jump address. Since the interrupt routine must continue after the inserted routine is done, I saved and restored all registers. A JP 3018H instruction ends the routine.

The programs in Listing 1 accomplish what I have just described for a 48K Model III with or without disks. There are three main programs, two subroutines used by the main programs and two short programs to enable and disable the spooler. The program to store all characters sent to the printer resides at FDA0H; the program inserted in the interrupt sequence is at FE00H. The program at FD70H accessed by a USR call from Basic dumps the buffer to the printer. The enable spooler routine at location FE40H puts in the addresses of my routines instead of the ROM addresses; the routine at FE70H reverses this process, disabling the spooler. With the routine at FE40H set as the starting point for execution after loading from disk, the spooler is on immediately after loading. The disable spooler routine is called from Basic via a USR call.

These programs use a predefined buffer area and communicate the current buffer end and beginning by using four bytes of memory as pointers. Addresses FDFCH and FDFDH hold the end of buffer address, FDFEH and FDFFH hold the beginning address. Initializing the pointers to the starting value of F000H sets the limits on the buffer; you can replace F000H at address FE51H with any starting address of the buffer. The next time the buffer is empty the pointers will be reset to this new value. The end of the buffer is set at FD60H so the program is not written over.

The programs also check memory bytes used as switches to control the spooler's operation. The byte at FDFAH controls whether the characters are stored or sent directly to the printer; a zero value here selects storage and anything else reverts to normal operation. Address FDFBH controls the interrupt routine. If it is zero, the cur-

Listing 1 continued

```
ROUTINE TO STORE ALL CHARACTERS SENT TO PRINTER
FDΔO
                                                    'DISARIE INTERRUPTS
FDA1
         F5
                       PUSH
                                 A, (FDFAH)
         3A FA FD
FE 00
                       LD
                                                   'GET SWITCH VALUE
'IS IT ZERO?
FDA2
FDA5
FDA7
         28
            05
                       JR
                                 Z,FDAEH
                                                    CONTINUE IF IT IS
                                                    RESTORE AF
FDA9
                       F:OF
                                                    ENABLE INTERRUPTS
FDAA
                       ΕI
FDAR
         C3 C2 O3
                       JP
                                 03C2H
                                                    RETURN TO PRCHAR IN ROM
                                                    TRANSFER CHARACTER TO A
                       LD
FDAE
                                 A.C
FDAF
            5B FC FD
                                 DE, (FDFCH)
                                                    GET END POINTER
                                                    SAVE CHARACTER
FDB3
         12
                       LD
                                 (DE),A
FDB4
                                                    NEXT LOCATION
                                HL,FD60H
EDB5
         21 60 FD
                       ı D
                                                    END OF BUFFER
                                                    'CHECK FOR OVERFLOW
'IF IT IS DUMP BUFFER
FDBB
         ΕD
            52
                       SBC
                                 HL. DE
FDBA
            CA FD
                       JP
                                 Z.FDCAH
                                                    REPLACE POINTER
FDBD
         ED 53 EC ED
                       ΙĐ
                                 (FDECH), DE
                                                    BALANCE STACK
FDC1
FDC2
         Εı
                       POF
                                 HL
                                                    BALANCE STACK
FDC3
                                                    RESTORE REGISTERS
FDC4
         DD E1
                       POP
                                 ΙX
                       POP
FDC<sub>6</sub>
         E1
                                 HL
FDC7
                                                    'ENABLE INTERRUPTS
FDC8
         FB
                       ΕI
FDC9
                                                    'RETURN TO CALLER
         21 C2 03
22 26 40
                                                    'ORIGINAL ADDRESS
FDCA
                       LD
                                 HL. 03C2H
FDCD
                                 (4026H),HL
                       LD
                                 HL, (FDFEH)
FDDO
         2A
            FE FD
                       LD
                                                    GET BEGINNING POINTER
         7E
                                                    GET CHARACTER
FDD3
                       LD
                                 A. (HL)
FDD4
                       PUSH
                                                    SAVE END POINTER
                                 003BH
EDD5
         CD 3B 00
                       CALL
                                                    PRINT CHARACTER
                                                    RESTORE POINTER
                       POP
                                 DE
FDD8
         D1
                                                    'NEXT CHARACTER
'CHECK FOR BREAK
FDD9
         CD 8D 02
                                 028DH
FDDA
                       CALL
                                 NZ, FE60H
                                                    ON BREAK EXIT
FDDD
                       JP
         C2 60 FE
FDEO
                       PUSH
                                                     SAVE CURRENT LOCATION
                       SBC
                                                    'CHECK FOR END
'RESTORE CURRENT LOCATION
FDE 1
         ED 52
                                 HL, DE
FDE3
                       POF
         E1
                                                    'LOOP IF NOT DONE
'RESET POINTERS
'STORE ROUTINE ADDRESS
'CHANGE PRCHAR JUMP
            D3 FD
                                 NZ.FDD3H
                       CALL
FDE7
         CD 50 FE
                                 FE50H
         21 A0 FD
22 26 40
                                 HL,FDAOH
(4026H),HL
FDEA
                       LD
FDED
                       LD
                                                    GOTO EXIT
         C3 C1 FD
                                 FDC1H
FDF3-FDF9
                             NOF
SWITCHES AND POINTERS
FDFA
                                                    'SWITCH FOR STORAGE
FDFB
         00
                                                     SWITCH FOR INTERRUPT
FDFC
         00
                                                    'END OF BUFFER POINTER
FDFD
         ΕŌ
         00
                                                    START OF BUFFER POINTER
FDFE
FDFF
ROUTINE INSERTED IN INTERRUPT SEQUENCE
FE00
                                                     SAVE AF
                        PUSH
         3A FB FD
FE OO
                                 A, (FDFBH)
FE01
                                                    'GET SWITCH VALUE
                                                    'IS IT ZERO?
FE04
                       CP
         28 04
                                                        IT IS CONTINUE
FE06
                                 Z, FEOCH
                                                    RESTORE AF
FE08
                       POF
FE09
         C3 18 30
                        JP
                                 3018H
                                 A, (FBH)
FOH
FEOC
         DB F8
                        IN
                                                    GET PRINTER STATUS
         E6 F0
FEOE
                       AND
                                                    CHECK IT
FE10
             30
                       CP
JP
                                 30H
         C2 08 FF
FE12
                                 NZ, FEOBH
                                                    'EXIT IF NOT READY
FE15
                        PUSH
                                                    'SAVE HL, DE
FE16
FE17
         D5
                       PUSH
                                 DE
         2A FE FD
                                 HL. (FDFEH)
                                                    GET BEGINNING POINTER
                       LD
FE1A
         ED
             5B
                FC FD
                       LD
                                 DE. (FDFCH)
FE1E
         E5
                        PUSH
                                 н
                                                     SAVE CURRENT LOCATION
                                                     CHECK IF BUFFER IS EMPTY
FE1F
         ED 52
                       SBC
                                 HL. DE
FE21
         E1
                        POF
                                                     RESTORE CURRENT LOCATION
         CA 2E FE
                                 Z.FEZEH
FE22
                                                     IF EMPTY GOTO EXIT
                        JP
FE25
                        LD
                                                    GET CURRENT CHARACTER
         D3 F8
                                 (FBH),A
                                                     SENT IT TO PRINTER
FE26
                        OUT
FE28
                        INC
                                                     POINT TO NEXT CHARACTER
FE29
         22 FE FD
                        LD
                                 (FDFEH),HL
                                                    'REPLACE POINTER
FE2C
         18
             03
                        JŔ
                                 FE31H
                                                     DON'T RESET POINTERS
FE2E
         CD
             50 FE
                        CALL
                                 FE50H
                                                     RESET POINTERS
FE31
         D1
                       POP
                                 DE
                                                    'RESTORE REGISTERS
                        POP
FE32
                                 HL
FE33
         F1
                       POP
         C3 18 30
FE34
                                 3018H
                                                    'CONTINUE WITH INTERRUPT SEQUENCE
FE37-FE3F
ROUTINE TO ENABLE
                     THE SPOOLER
FE40
                                 HL, FDAOH
                                                    LOCATION OF STORE ROUTINE
                       LD
FE43
FE46
         22 26 40
21 00 FE
                       LD
                                 (4026H),HL
                                                     CHANGE PRCHAR JUMP
                       LD
                                 HL. FEOOH
                                                     LOCATION OF INTERRUPT ROUTINE
FE49
         22
             13 40
                                                     CHANGE INTERRUPT JUMP
                                 (4013H), HL
FE4C
         C3 2D
                40
                       JP
                                 402DH
                                                    'RETURN TO DOS
FE4F
SUBROUTINE TO RESET POINTERS TO START OF BUFFER
FF50
         21 00 FO
                       LD
                                 HL.FOOOH
                                                    'START OF BUFFER
                                                                                Listing 1 continues
```

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rent byte in the buffer is sent to the printer every interrupt cycle, otherwise nothing is done. This allows all the data printed by a program to be stored and dumped at once, using the routine at FD70H after program execution is complete. If the buffer is filled, the contents will be sent to the printer regardless of the status of the byte at FDFBH. This ensures no lost data on buffer overflow.

#### Use

The spooler program given here is invisible; when in place the only sign of its operation is the Ready prompt under Basic or DOS while the printer is running. The program can be entered with a disk system by using Debug to POKE the values into memory and then using DUMP to save it to disk. When dumping the program to disk, set TRA = 0FE40 so the program is enabled immediately when it is called under DOS. Make sure the pointers are included in the dump and are both set to F000H; Listing 1 continued

FE53 22 FE FD LD (FDFEH), HL 'RESET START POINTER FE56 22 FC FD LD (FDFCH), HL 'RESET END POINTER FE59 C9 RET 'RETURN FE5A-FE5F 00 NOP

EXIT ROUTINE ON BREAK

FEAO CD 50 FE CALL FE50H RESET POINTERS 'LOCATION OF STORE ROUTINE 'REPLACE JUMP ADDRESS FE63 21 AO FD LD FE66 22 26 40 I D (4026H) H FFA9 ENABLE INTERRUPTS 1A19H FE6A C3 19 1A JP JUMP TO BASIC READY FE6D-FE6F

ROUTINE TO DISABLE THE SPOOLER BY A USR CALL

FE70 21 C2 03 HL . 03C2H ORIGINAL PRCHAR ADDRESS 22 26 40 21 1B 30 22 13 40 LD (4026H) .HL REPLACE IT FE76 LD ORIGINAL INTERRUPT ADDRESS HL. 3018H FE79 LD (4013H).HL REPLACE IT FE7C RETURN TO CALLER

Listing 1: Commented disassembly of spooler as it should be loaded into memory.

or the program will try to send the empty buffer to the printer. Set the switch values to the status desired when the program is loaded. Without disks, use Listing 2 to POKE the program into memory. At FE4CH the jump to DOS (402DH) is replaced with a return (C9) instruction allowing the spooler to be enabled by the Basic USR call in the program.

#### Program Listing 2

10 CLS:DEFINT I
20 SUM=0
30 PRINT"PROGRAM TO LOAD SPOOLER FOR THE"
40 PRINT"MODEL III, BY TOM SHIELD, AUGUST 1981"
50 PRINT"MEMORY SIZE SHOULD BE SET AT 61480"
60 FORI=-656 TO -388 'LOAD FROM FD70H TO FE7CH
70 READ BYTE
80 POKE I, BYTE
90 SUM=SUM+BYTE
100 IF SUM<31413 THEN PRINT"CHECK SUM ERROR, CHECK 'DATA' STATE

Listing 2 continues

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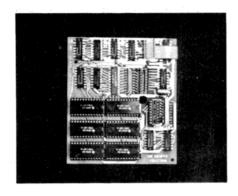
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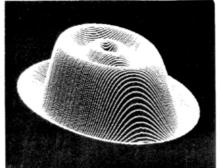
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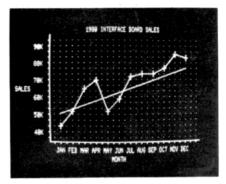
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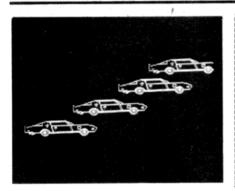


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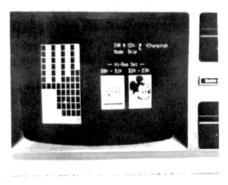
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Under Basic answer the memory size question with 61400 to protect the program and its buffer. Different buffer sizes require a different setting. Under DOS, the program needs to be protected from being overwritten by commands that use the top 180H of memory. Executing a Clear (MEM = 0F000) under DOS allows the spooler to execute under DOS as well as Basic. Failure to do this causes the machine to hang up when the program is erased and the interrupt sequence branches to a nonexistent routine.

The spooler stores data and sends it to the printer when it is available; since the buffer size is fixed, only a limited amount of data can be stored. If the buffer is filled faster than it is printed, it will eventually be full. When this happens the whole buffer is dumped to the printer so that no data are lost. Since this is done by the character storing routine, the Ready prompt will not appear until the buffer is empty and normal operation has resumed. If you do not want the buffer contents or simply need to stop sending data to the printer, Break stops execution and clears the buffer. This is also true for the routine to dump the buffer via a USR call. Since the interrupt routine only sends data to the printer when it is ready you can put your printer off-line to change

or adjust the paper while a program is running without stopping its execution.

A spooler is a very useful utility but you must understand what it does to maximize its use. If a program producing output is slower than the printer you do not need the spooler: The printer will be ready when the program needs it. If you use programs that need large amounts of memory or do word-processing with big documents, using memory as a buffer is detrimental to normal operation. On the other hand, if you have a short program to LLIST, after which you would like to look at a disk directory or run the program, it is great to get the Ready prompt almost before the printer starts. Or if you want to print 10 each of various mailing labels you can enter the next address while the previous one is still printing! The advantages are endless. The sound of most printers is not very musical; with a spooler I

#### Listing 2 continued

MENTS\*:END ELSE PRINT\*LOAD COMPLETE, AND SPOOLER RUNNING\*
128 POKE 16526,64:POKE 16527,254 'WITH DISKS DEFUSR8=&HFE48
138 X-USR(0) 'OR LUSR8(0) WITH DISKS
148 PRINT\*SOME IMPORTANT ADDRESSES ARE:
159 PRINT\* -448 (&HFE40)=LOCATION OF ENABLE SPOOLER ROUTINE\*
169 PRINT\* -466 (&HFE70)=LOCATION OF PRINT BUPFER ROUTINE\*
178 PRINT\* -518 (&HFD70)=LOCATION OF PRINT BUPFER ROUTINE\*
188 PRINT\* -517 (&HFDPA)=LOCATION OF STORE SWITCH\*
198 PRINT\* -517 (&HFDPA)=LOCATION OF INTERRUPT SWITCH\*
208 END
218 DATA 243, 33, 194, 3, 34, 38, 64, 237
228 DATA 75, 252, 253, 42, 254, 253, 126, 285
238 DATA 59, 0, 35, 205, 141, 2, 194, 96
248 DATA 254, 229, 237, 66, 225, 194, 126, 253
258 DATA 265, 88, 254, 33, 168, 253, 34, 38
268 DATA 243, 245, 58, 259, 253, 254, 0, 40
278 DATA 243, 245, 58, 259, 253, 254, 0, 40
280 DATA 5, 241, 251, 195, 194, 3, 121, 237
298 DATA 243, 245, 58, 259, 253, 254, 0, 40
280 DATA 241, 251, 195, 194, 3, 121, 237
298 DATA 237, 82, 262, 262, 253, 237, 83, 252
318 DATA 237, 82, 262, 262, 253, 237, 83, 252
318 DATA 237, 82, 262, 262, 253, 237, 83, 252
318 DATA 251, 281, 33, 194, 3, 34, 38, 64
338 DATA 42, 254, 253, 126, 213, 205, 59, 0
348 DATA 269, 35, 265, 141, 2, 194, 96, 254
358 DATA 269, 237, 82, 225, 194, 211, 253, 265
360 DATA 80, 254, 33, 160, 253, 34, 38, 64
378 DATA 269, 237, 82, 225, 194, 211, 253, 265
360 DATA 264, 253, 237, 80, 0, 8, 9, 8
380 DATA 251, 281, 285, 285, 246, 248, 239, 240
418 DATA 254, 289, 257, 267, 467, 254, 126, 211, 248
448 DATA 254, 195, 24, 48, 219, 248, 239, 249
418 DATA 254, 289, 254, 253, 254, 6, 49, 4
488 DATA 254, 289, 252, 267, 467, 254, 126, 211, 248
448 DATA 254, 289, 254, 253, 244, 259, 213, 42
420 DATA 35, 34, 254, 253, 244, 252, 253, 229, 237
438 DATA 254, 289, 254, 253, 244, 269, 246

360 DATA 33, 160, 253, 34, 38, 64
370 DATA 33, 160, 253, 34, 38, 64
370 DATA 33, 160, 253, 34, 38, 64
380 DATA 254, 289, 255, 241, 195, 24, 46, 8
480 DATA 254, 289, 255, 267, 67, 8
480 DATA 253, 281, 94, 34, 254, 253, 34, 38
480 'IN LINE 490 FOR DISK REPLACE 201=1915, 0=>45, 0=>64
480 DATA 3

#### Program Listing 3

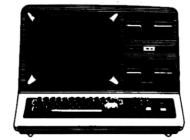
FEBO	7E	LD	A, (HL)	'GET 1ST CHARACTER AFTER FILESPEC
FE81	FE OD	CP	ODH	'IS THERE NONE?
FE83	CA DC FE	JP	Z,FEDCH	'THEN JUST ENABLE SPOOLER
FE86	CD OO FF	CALL	FFOOH	'CONVERT TO HEX
FE89	E5	PUSH	HL	'SAVE POSITION
FEBA	21 00 10	LD	HL,1000H	'MULTIPLIER FOR 1ST DIGIT
FE8D	D5	PUSH	DE	'SAVE DE
FE8E	CD 4E 44	CALL	444EH	'CALL \$DMULT
FE91	D1	POP	DE	'RESTORE DE
FE92	65	LD	H,L	'MOVE MIDDLE BYTE
				Listing 3 continues

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**/** 138

#### Listing 3 continued

sing 5 com	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			
FE93	6F	LD	L,A	'MOVE LOWER BYTE
FE94	EB	EX	DE, HL	'SAVE RESULT
FE95	E1	POP	HL	'RESTORE POSITION OF BUFFER
FE96	23	INC	HL	'NEXT CHARACTER
FE97	CD OO FF	CALL	FFOOH	CONVERT TO HEX
FE9A	E5	PUSH	HL	'SAVE POSITION
FE9B	21 00 01	LD	HL,0100H	'MULTIPLIER FOR 2ND DIGIT
FE9E	D5	PUSH	DE	'SAVE DE
FE9F	CD 4E 44	CALL	444EH	'CALL \$DMULT
FEA2	D1	POP	DE	'RESTORE DE
FEA3	65	LD	H,L	'MOVE MIDDLE BYTE
FEA4	6F	LD	L,A	'MOVE LOWER BYTE
FEA5	ED 5A	ADC	HL, DE	'ADD IN EARLIER RESULT
FEA7	EB	EX	DE, HL	'SAVE IT
FEA8	E1	POP	HL	'RESTORE BUFFER POSITION
FEA9	23	INC	HL	'NEXT CHARACTER
FEAA	CD OO FF	CALL	FFOOH	'CONVERT TO HEX
FEAD	E5	PUSH	HL	'SAVE POSITION
FEAE	21 10 00	LD	HL,0010H	'MULT FOR 3RD DIGIT
FEB1	D5	PUSH	DE	'SAVE RESULT
FEB2	CD 4E 44	CALL	444EH	'CALL \$DMULT
FEB5	D1	POP	DE	'RESTORE TOTAL
FEB6	65	LD	H.L	'MOVE MIDDLE BYTE
FEB7	6F	LD	L,A	'MOVE LOWER BYTE
FEB8	ED 5A	ADC	HL, DE	'GET TOTAL
FEBA	EB	EX	DE, HL	'SAVE IT
FEBB	E1	POP	HL	'RESTORE BUFFER POSITION
FEBC	23	INC	HL	'NEXT ONE
FEBD	CD OO FF	CALL	FFOOH	'CONVERT TO HEX
FECO	6F	LD	L,A	'LOW ORDER BYTE
FEC1	26 00	LD	н, оон	'HIGH ORDER BYTE
FEC3	ED 5A	ADC	HL, DE	'ADD TO TOTAL
FEC5	11 00 80	LD	DE,8000H	'LOWER LIMIT ON BUFFER
FEC8	E5	PUSH	HL	'SAVE TOTAL
FEC9	ED 52	SBC	HL, DE	'CHECK IT
FECB	E1	POP	HL	'GET TOTAL
FECC	FA DC FE	JP	M, FEDCH	'EXIT IF TOO LOW
FECF	E5	PUSH	HL	'SAVE TOTAL
FEDO FED3	11 60 FD	LD	DE, FD60H	UPPER LIMIT ON BUFFER
FED5	ED 52 E1	SBC POP	HL, DE	'CHECK IT
FED6	F2 DC FE	JP	HL D. FERSON	GET TOTAL
FED9	22 51 FE		P,FEDCH	'EXIT IF TOO HIGH
FEDC	21 AO FD	LD LD	(FE51H),HL	'CHANGE BUFFER POINTER
			HL, FDAOH	STORE ROUTINE ADDRESS
FEDF FEE2	22 26 40	LD	(4026H),HL	'CHANGE LPRINT JUMP
FEE5	21 00 FE 22 13 40	LD	HL, FEOOH	'INTERRUPT ROUTINE ADDRESS
FEE8	22 13 40 C3 2D 40	LD	(4013H),HL	'CHANGE INTERRUPT JUMP
FEED	C3 2D 40	JP	402DH	JUMP TO DOS
FEEB-FEF	FF 00	NO	P	'OR ANYTHING
FF00	7E	LD	A. (HL)	'GET CHARACTER
FF01	FE 40	CP	40H	COMPARE TO 40H
FF03	F2 OA FF	JP	P.FFOAH	'IF LETTER JUMP
FF06	DE F2	SBC	A, 2FH	CORRECTION FOR NUMBERS
FFOB	18 02	JR	FFOCH	GOTO RETURN
FFOA	DE 37	SBC	A, 37H	CORRECTION FOR LETTERS
FFOC	C9	RET		RETURN

Listing 3: Routine to set the buffer size when the spooler is called from DOS. It is simply added to the rest of the program with TRA=FE80 on dump to disk.

spend less time listening and staring at a lifeless screen.

#### **Program Refinements**

I have made two additions to the program for DOS users only. You can solve the problem of executing a CLEAR (MEM = xxxxx) by applying the following patch to the spooler once it is on disk:

PATCH SPOOL/CMD (ADD = 0FE59,FIND = C9000000,CHG = 221144C9)

This patch automatically protects the spooler from DOS. The program in Listing 3 sets the start of the buffer when the spooler is called from DOS. Add this segment to the end of the spooler program and DUMP from FD70H to FF0CH to disk setting TRA = 0FE80. The program reads the first four characters after the filespec (the normal TRSDOS syntax) and uses that address as the new beginning for the buffer. You must enter the address in hexadecimal format with no leading characters. To set the start of the buffer to D000H execute under DOS: SPOOL D000. If no address is entered the default value of F000H is used as before. Note you must still protect the spooler under Basic. Another useful trick is to DUMP the code at FE70H to FE7CH with TRA = 0FE70 under the name of SPOOLOFF. Entering SPOOL-OFF from DOS turns the spooler off.

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# Now where did I put these files?

# Diskmap

LCDR John B. Harrell, III RR 1, Box 841, Tatnic Rd. Wells, ME 04090

have wondered many times just how the Disk Operating System places files on the disk. I have had to worry about the placement of files when moving from one disk system to the other especially if the track count for the drives is different. One may easily find file locations with a utility such as Apparat's Superzap and a reference such as the TRS-80 Disk

and Other Mysteries by H.C. Pennington. This is time-consuming and requires constant reference to the book to remember what the information presented means.

Diskmap uses the information in Pennington's book to present file structure concisely. Figure 1 shows the type of display that Diskmap constructs, repeated four times to map a 40-track disk. I have found it useful to look at the directories of disks with no system on them. Diskmap was written to be independent of the major operating systems primarily by the inclusion of disk read and manipulation routines.

#### Floppy Disk Formatter/Controller

At the heart of this utility pro-

gram are the disk control and input routines. To understand these routines, you must understand how the disk is interfaced with the expansion interface and the Western Digital FD1771-01 floppy disk formatter/controller chip.

The Floppy Disk Controller (FDC) takes commands from the computer and uses them to position the proper disk head and to read data from or write data to the storage medium (the disk). The FDC interface to the computer is an 8-bit bidirectional bus for data, status, and command transfers. On the TRS-80 this interface consists of memory-mapped addresses for each FDC register. Data flow to or from the FDC is controlled by one of the addresses in Table 1 in a memory-store or memoryload operation.

There are eleven commands used with the FDC: These commands are divided into four groups. Refer to Table 2 for the structure of the commands. Each command is issued to the FDC by a store operation to the command register (X'37EC') using the appropriate command. Obtain the status of the command just issued from a load from the Status register (X'37EC'); interpret it by reference to Table 3. A Read Sector command is performed by first seeking the correct track and looking at status to determine the state of the Busy bit, while waiting for the command to terminate. The appropriate sector number is then stored in the Sector register and the Read command is issued. The program then polls the DRQ and BUSY bits to determine the state of the Read command.

The Restore command repositions the disk head over track zero and the FDC Track register is set to zero at the termination of the operation. The h field, the Head Load flag, causes no action on the TRS-80 as the head is loaded when the disk is selected and the drive motor is turned on. The v flag causes the FDC to verify that the track number on the track last read is the same as the contents of the Track register. The last field, rr, controls the rate at which the FDC issues stepping pulses to the disk. The stepping rates for the disk head given in Table 2 are for an FDC using a one Megahertz clock; a 2 MHz clock halves these times. These three fields are the same for the remainder of the Type I commands.

\*DISK GRANULE MAP DRIVE-0 NEWDOS80 02/20/81 **GRANS FREE:3** TRKS LOCKED OUT:0 1ST GRANULE **2ND GRANULE** TRACK NUMBER: 0 <-- BOOT/SYS -->.<-- SYS0/SYS -->. TRACK NUMBER: 1 <-- SYS0/SYS -->.<-- SYS0/SYS --TRACK NUMBER: 2 .<- LMOFFSET/CMD ->.<- LMOFFSET/CMD ->. TRACK NUMBER: 3 .<- LEVEL1/CMD -->.<--LEVEL1/CMD--> TRACK NUMBER: 4 .<- LEVEL1/CMD -->.<--LEVEL1/CMD-->. **TRACK NUMBER: 5** BUILDER -->.<-- BUILDER -->. TRACK NUMBER: 6 .<--- VERIFY/JCL --->.<- SPOOLER/CMD ->. TRACK NUMBER: 7 .<- SPOOLER/CMD ->.< --TRACK NUMBER: 8 -- >.<- SAMPLE01/BAS ->. TRACK NUMBER: 9 <-- SAMPLE01/BAS -> <- SAMPLE01/BAS ->. PRESS ANY KEY FOR NEXT 10 TRACK DISPLAY Fig. 1. Disk Granule Map

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The Seek command tells the FDC to compare the track number in the Data register (a previous instruction must load the Data register) with the current contents of the Track register. The FDC then issues the appropriate number of stepping pulses in the correct direction to cause the head to travel to the desired track.

The Step command causes the FDC to issue one step pulse to the selected drive's head. The direction of the Step is the same as the direction of the last Step issued. The u field updates the Track register to the proper value for the corresponding track. If the u flag is not used, the user must keep track of the disk head location.

The two commands Step-In and Step-Out are similar to Step except that the direction of head travel is explicitly defined in the command. All fields in these commands operate as in the Step command.

The second group of FDC

commands are data movement commands for reading and writing data to or from the disk. The adaption used to transfer data in the TRS-80 is called Programmed input/output. The Z80 Central Processing Unit (CPU) must continually poll the FDC and be ready to accept or provide data. This concept is opposed by the Direct Memory Access (DMA) method. With DMA the FDC actually demands and receives full control to the address and data busses of the computer; data transfers directly to the memory store without the CPU. This allows overlapped execution with data transfer and alleviates the I/O bound central processor.

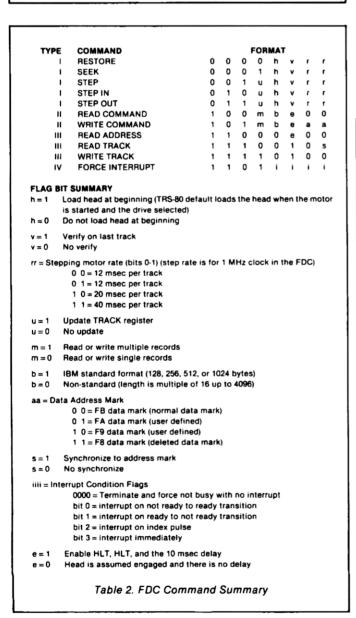
There are several requirements before the performance of Read or Write commands. First, the drive must be selected and the motor must be up to normal operational speed. TRSDOS and NEWDOS 2.1 assume that this time delay is approximately one second. NEWDOS80 sets this delay at one-half second. Second, a Seek instruction must po-

sition the head over the appropriate track. Third, the Sector register in the FDC must be set to the number of the sector to be read or written.

The format of the Read and Write commands is in Table 2. Note that they have similar fields of m, b, and e. The m field enables a multiple sector transfer of information. The FDC transfers information and updates the sector register until the sector register contains a number larger than the highest sector number on the track or until a Force Interrupt command is loaded into the Command reqister. The b field identifies the format type as standard IBM or non-standard. This changes the FDC's interpretation of the sector length code and is part of the record identification. The e field is not used in the Model I. On the Write command, the aa field specifies the type of Data Address Mark (DAM) for the sector transferred. The standard DAM is an X'FB' for all sectors other than the directory (DIR/SYS), which uses DAM X'FA' to show

TRS-80 ADDRESS	MEMORY LOAD	MEMORY STORE
X'37E1'	N/A	Select drive & start
X:37EC.	Read STATUS reg	Load COMMAND reg
X:37ED'	Read TRACK reg	Load TRACK reg
X-37EE	Read SECTOR reg	Load SECTOR reg
X'37EF'	Read DATA reg	Load DATA reg

Table 1. Memory Map





read protection. This is why you get error code six if you attempt to read the sector in Basic. You can read the directory from a Basic program if you trap this error and if you change byte 01 in sector 1 (the HIT sector) from 2CH to C4H.

Group III commands include the following: Read Address, Read Track, and Write Track. These commands are used to format a disk and to verify that it can be read. The Read Address command reads the six identification bytes from the disk in the next ID field. These six bytes are:

Track Address (zero to num-

- ber of track minus one)

  Side Number (usually reflects the side of the disk; in TRSDOS disks this value is zero)
- Sector Address (usually zero through nine)
- Sector Length
- Two CRC bytes

Read Track reads the entire track of information: the data, the ID bytes and all the gaps. Information is transferred similar to the Read command. The Data Request Bit (DRQ) signals when data has been assembled by the FDC and is ready for transfer.

Write Track is used principally to format the disk by writing appropriate control information to the disk. This command is not normally used to write data to the disk as several bytes have special meaning to the FDC (bytes X'F7' through X'FE'). The use of these special bytes is described in Table 4.

The last command group has only one command. Force Interrupt stops the FDC and forces it to generate an interrupt. If any conditions in the command are set (see Table 2), the command forces the FDC to terminate, drop the BUSY status bit, and interrupt. If none of these conditions are selected, the FDC terminates the current operation and resets BUSY without interrupt.

Disk structure is generally standard IBM format; the disk is formatted using sector multiples of 128 bytes (128,256,512, or 1024 bytes). The non-standard disk is formatted to use a sector having a length that is a multiple

BIT	NAME	MEANING
S7	Not Ready	The selected drive is not ready.
S6	Protected	The Write Protect tab is on the disk.
S5	Head Loaded	Indicates the head is loaded and engaged.
S4	Seek Error	The desired track was not verified.
<b>S</b> 3	CRC Error	There was at least one CRC error on a track verification operation.
S2	Track Zero	The current position of the head is over track zero.
S1	Index	The index mark from the drive has been detected by the FDC.
S0	Busy	The FDC has a command in progress.
Status f	or Type II/III comman	ds
BIT	NAME	MEANING
S7	Not Ready	The selected drive is not ready. Type II/III
		commands will not execute if the drive is not
		ready.
S6	Record Type Write Prot	On a Read record, this bit indicates part of a two bit representation which is indicative of the type of Data Address Mark (DAM) en- countered. On a Write record, this bit re- flects write protect status.
<b>S</b> 5	Record Type Write Fault	On a Read Sector command, this is the sec- ond of the bits for type of DAM found. On a Write Track command, it indicates a write fault.
S4	Rec Not Fnd	The sector and/or the track were not found at the current head location.
<b>S</b> 3	CRC Error	A CRC error was detected during a read command.
S2	Lost Data	The program did not respond to the DRQ within the time frame of being able to read or write two bytes to the disk.
S1	Data Req	The Data register has been filled when exe- cuting a Read command or has been emp- tied while performing a Write command.
S0	Busy	The FDC is busy with the current command.

Table 3. Status Register Summary

# OF JUMP #WERT 1-0080000- 2-01 103321 108172 104000 102

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of 16 bytes; this length varies from 16 to 4,906 bytes if the track is large enough.

The type of sector to be read or written is determined by the b flag in the command; the length is determined from the sector length field stored in the ID field (remember the information read using a Read Address command?).

#### Diskmap

Diskmap uses little sophisticated coding and no trickery to provide the disk user with a visual display of every file on the disk. Using the NEWDOS80 information, I could have written this utility to default to the parameters identifying each disk at a system boot. This would

1	
Byte	Description
F7H	Write CRC bytes
F8H-FBH	Write Data Address Marks
FCH	Write Index Address Mark
FDH	Spare
FEH	Write ID Address Mark
l	

Table 4. Special Bytes

have made Diskmap incompatible with the other disk operating systems so the user defines the directory track and the number of tracks at assembly time. As Program Listing 1 shows, this version was assembled with the directory default set to track 17 and the number of tracks set at 40

Diskmap performs a disk map on a systemless disk. If you have a single disk drive system, it becomes very difficult to do even a directory (particularly in NEWDOS80 where a new overlay is loaded for each command entered). Hold the break key down after entering the command name. The program will pause; place the appropriate disk in drive 0 and then press Enter to map the disk.

Clock interrupts must be turned off when attempting any data transfer to or from the disk. Failure to turn off the 25 msec interrupt terminates the disk read or write with the Lost Data bit posted. This means that the FDC attempted to access the Data register twice without an

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intervening access to the Data register by the computer. I turn interrupts off at the beginning and re-enable interrupts at the end as I do not use the display clock. Disable interrupts before each disk I/O operation and reenable interrupts before each exit or the exit from the read/ write routine.

Next, determine the drive number (drive 0 always for the break key pause) and from this the proper select bit. The select bit is always  $2^*N (N = 0,1,2,3)$ . The DOS command buffer is scanned for a X'OD' following Diskmap; if none is there, it checks for a blank. The drive number is then checked for validity.

After the proper drive has been determined, the FDC is issued a Reset to Not Busy command. The drive is selected and a loop is entered waiting for a change in the Index pulse as the drive rotates the disk. If approximately two full revolutions pass without a change in the Index pulse, the drive is declared not ready and the utility terminates in error.

Next, the user must reselect the drive and establish the head position. The FDC remembers the head location (Track register) for only one drive at a time; this is only valid if the update flag was used when moving the head last. The program performs a Restore to Track Zero command using the 20 msec/ track stepping time. This moves the head to track zero and resets the Track register to zero. Next, the Data register is loaded with the number corresponding to the Directory Track number (default value is 17 decimal) and a Seek command moves the head to track 17 on the selected drive. In lines 116-134 (see the Listing) the Push/Pop sequence is a delay between use of the X'37EC' port to address the Command register and then address the Status register. The Bit instruction tests the Busy bit

to determine when the operation is complete.

Lines 135-138 establish conditions necessary to perform the sector read loop. Line 139 issues the Read Record command (see Table 2); the heart of the read loop is lines 147-153. The DRQ bit is tested to see if a data byte has been assembled. ready for the computer to store (DRQ = 1). If DRQ is not true ("true" refers to single bits equaling one), then the Busy bit is checked. If Busy is still true, continue to status DRQ until a byte is ready. When DRQ is true. a byte has been assembled and may be stored in the buffer.

When DRQ and Busy are both false, one sector has been read and the FDC is no longer busy. The Status word is examined for any errors detected on the read. No attempt is made to examine the status word for information concerning the Data Address Marks just read. I have assumed that the directory track was read and did not check for the appropriate DAM (a Directory Track is read-protected by writing the sectors with a DAM of X'FA' rather than the IBM normal of X'FB').

The disk sector read routine is repeated nine more times to copy the entire directory track to the buffer. Beginning at the address specified by Buffer is the GAT sector of the directory. The GAT sector contains the Granule Allocation Table beginning at offset byte 0; the Track Locked Out Table beginning at offset byte 60H; and the disk name and creation date starting at offset byte D0H and D8H respectively. This information is used in lines 170-232 to build the subtitle line for the video screen.

The string array MAP contains 80 entries corresponding to each granule; each entry is 13 bytes long. This allows the map to be built prior to display using filenames in the form of FILE-SPEC/EXT. This array must be

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To build the array Map, lines 260-306 read all non-null entries in the directory and reconstruct the filespec for each in the locations in MAP corresponding to the extent information in each File Primary Directory Entry (FPDE).

Interspersed with the FPDEs in the directory may be File Extension Directory Entries (FXDE). Table 5 explains the byte/bit structure for FPDEs and FXDEs found in the directory. FXDEs are an additional area for the disk operating system to keep information about the FPDEs. The last entry in the chain of information concerning the file's disk location must start with an X'FF' byte. If the DOS must have more than four entries to contain the information about a file, the last entry in the FPDE starts with X'FE' and the second byte is a Directory Entry Code (DEC) describing the location of the corresponding FXDE in the directory. When an FXDE is detected in line 298, the IX register is set to the appropriate value in the buffer corresponding to the location of the FXDE. This is per-

Byte 0 Bit record for file attributes Bit 7-1 = FXDE. 0 = FPDE Bit 6— 1 = System File, 0 = Not System File Bit 5- Not used Bit 4-1 = Directory entry is assigned to a file 0 = Directory entry is free Bit 3-1 = invisible file, 0 = Visible file Bits 2-0- Protection attributes for each file 111-No access is allowed 110-Execution access only 101-Read/Execute access 100-Write/Read/Execute access 011-Not used 010-Rename/Write/Read/Execute access 001 - Kill/Rename/Write/Read/Execute access 000-Full access Not used in an FPDE; in an FXDE, this byte is used as a DEC Byte 1 to point back to its FPDE. Byte 2 Not used in an FPDE or FXDE. Byte 3 Used as the end of file byte pointing to the relative byte in the sector that is the physical end of this file. Byte 4 Logical record length (0 = 256 bytes). Bytes 5-C File Name, left-justified blank-filled format. Bytes D-F File Name Extension in same format Bytes 10-11 Two byte hash-code value for the update password. Bytes 12-13 Two byte hash-code value for the access password. This is the EOF sector or the number of the sectors in the Bytes 14-15 file. If Byte 3 is 00H then this is the actual sector count. If Byte 3 is not 00H then the actual sector count is this value Bytes 16-17 These last five pairs of bytes form extent information which locate the file on the disk. Each 2-byte extent has the track 18-19 number for the file, the starting granule, and number of con-1A-1B 1C-1D tiguous granules for this extent. If more extents are needed 1E-1F to describe a file than are available in the FPDE, the last extent is coded to point to an FXDE for additional extent storage Consider the following Extent: 1C 24

The first byte of this extent is the track number of the start of the file in this extent, e.g. track 1CH or 28. The second byte is two packed values which are the granule number (0 or 1) and the number of contiguous granules in this extent less one. In this example 24H is 0010 0100 binary. The left three bits represent the granule number and the right five bits represent the count of contiguous granules; 001 = granule 1 or sector 5 and 00100 = 4 + 1 or five contiguous grans in this extent. If the first byte is FFH, this signifies the end of the file extents. A first byte of FEH signifies a pointer to an FXDE follows in the second byte and may be interpreted as follows: The left three bits of the second byte multiplied by 32 is the offset of the FXDE in the directory sector described by the right three bits. These three bits are the offset from the HIT sector; add two to them to reflect the right sector on the directory track. The extent FE 63 is interpreted as follows: 63H equals 0110 0011 binary. The right three bits plus two tell you that the FXDE is in sector 5 on the directory track and the FXDE is in entry 011 binary\*20H or offset address 60H. The only bytes used in constructing an FXDE are bytes 0, 1, and 16 through 1F; all other bytes are zeroed.

Table 5. FPDC and FXDE directories

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Having constructed the Map array, the screen is cleared and the prototype structure is displayed by the code in lines 312-343. Once this is completed, the PAGES and TRK counters step through the Map array and display the disk map 10 tracks at once (see lines 348-447).

#### Diskmap On Disk

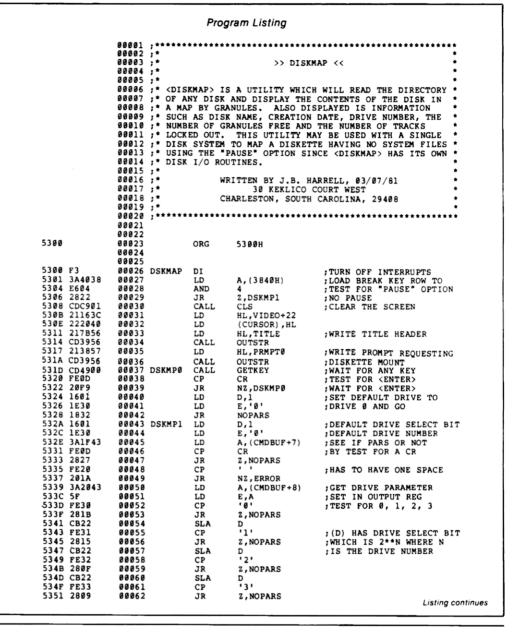
If you have an editor/assembler capable of reading and writing disk source files, enter the source code and assemble the program to disk.

If you are not so fortunate, enter the code into the tape version of the editor/assembler and assemble and write the object code to tape. When you have created an object tape, use LMOFFSET or Tapedisk to load the tape to disk. The disk Dump command for Tapedisk is "F DISKMAP/CMD:d 5300 5846 5300".

#### Compatibility

This utility runs under NEW-DOS80, NEWDOS 2.1, and TRS-DOS. Diskmap uses a few ROM routines that are relatively independent of the TRS-80 ROM configuration.

This useful program now resides on my disk along with DIRCHECK and SUPERZAP as one of my most-used utilities.



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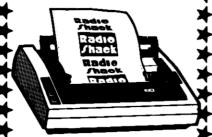
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Listing continued				
5353 219156	99963 ERROR	LD	HL, ERR1	; ILLEGAL PARAMETER FOUND
5356 CD3956 5359 C3EE55	00064 00065	CALL JP	OUTSTR DOSEXT	;REENABLE INTERRPUT - RET
535C 7A	88866 88867 NOPARS	LD	A,D	; SAVE SELECT BIT
535D 321857 5360 7B	99968 99969	LD LD	(SELBIT),A A,E	;SAVE DRIVE NUMBER IN
5361 32BA56 5364 32D156	00070 00071	LD	(DRNR),A	; VARIOUS MESSAGES
3364 320136	00072	LD	(DRVNR),A	•
	00073 ; NOW 00074 ; IS T	THAT THE O SELECT	PARAMETER HAS I	SEEN DECODED, THE NEXT TASK TO SEE IF IT IS READY BY
	00075 ; READ	ING THE	INDEX PULSE BIT	AND MAKING SURE THAT IT
	00077 ; IT D	OES - OK	, IF NOT - THEN	DISKETTE IS NOT READY FOR
5367 3mp4	00079			
5367 3EDØ 5369 32EC37	00080 00081	I'D I'D	A,0D0H (CMDREG),A	;FDC COMMAND - QUIT OPS ;TERMINATE, RESET "BUSY"
536C 3A1857 536F 32E137	00082 00083	LD LD	A,(SELBIT) (SELECT),A	GET DRIVE SELECTED; SELECT IT AND START MTR
5372 010080 5375 CD6000	08084 00085	LD CALL	BC,8000H DELAY	
5378 3A1857 537B 32E137	00086 00087	LD	A, (SELBIT)	;WAIT ONE-HALF SECOND ;RESELECT DRIVE
537E E5	00088	LD PUSH	(SELECT),A HL	
537F E1 5380 E5	00089 00090	POP PUSH	HL HL	; WASTE TIME
5381 E1 5382 3AEC37	00091 00092	POP LD	HL A,(STATUS)	; READ STATUS REGISTER
5385 E602 5387 5F	00093 00094	AND	2	; INDEX PULSE BIT
5388 Ø11027	00095	LD	E,A BC,10000	;SAVE IT ;COUNT FOR APPRX 2 REVS
538B 3A1857 538E 32E137	00096 00097	LD LD	A,(SELBIT) (SELECT),A	
5391 3AEC37 5394 E602	00098 TEST 00099	LD AND	A,(STATUS)	;GET STATUS WORD
5396 BB 5397 200E	00100 00101	CP JR	E N2,READY	;SEE IF INDX BITS ARE = ;NO - IT MUST BE OK
5399 ØB 539A 78	00102 00103	DEC	BC	DECR COUNT
539B B1	00104	OR	A,B C	
539C 20F3 539E 21AE56	00105 00106	JR LD	NZ,TEST HL,ERR2	;DRIVE X IS NOT READY
53A1 CD3956 53A4 C3EE55	00107 00108	CALL JP	OUTSTR DOSEXT	
	00109 00110 ; NOW	THAT THE	DRIVE HAS BEEN	DETERMINED TO BE IN AN
	00111 : OPER	ATIONAL :	STATUS, RESTORE	THE DRIVE TO TRACK Ø TO EAD IS AND THEN SEEK THE
	MATIS : "DIE	TRK". R	EAD 10 SECTORS F	ROM "DIRTRK" AND STORE IN
5217 211057	00114 ; BUFF 00115		ATER USE.	
53A7 3A1857 53AA 32E137	00116 READY 00117	LD LD	A,(SELBIT) (SELECT),A	;RESELECT DRIVE
53AD 21EC37 53BØ 36ØE	00118 00119	LD LD	HL,CMDREG (HL),8EH	;SET UP ROUTINE ;RESTORE - 20MS/TRACK
53B2 E5 53B3 E1	00120 00121	PUSH POP	HL HL	, and the second second
53B4 E5 53B5 E1	00122 00123	PUSH	HL	
53B6 CB46	00124 READ1	BIT	HL 0,(HL)	; TEST FOR BUSY BIT
53B8 20FC 53BA 3E11	99125 99126	JR LD	NZ,READ1 A,DIRTRK	;WAIT TILL NOT BUSY ;SET UP SEEK
53BC 32EF37 53BF 361E	00127 00128	LD LD	(DATARG),A (HL),1EH	; SEEK - 20MS/TRACK
53C1 E5 53C2 E1	00129 00130	PUSH POP	HL HL	,
53C3 E5	00131	PUSH	HL	
53C4 E1 53C5 CB46	00132 00133 READ2	POP BIT	HL 8,(HL)	
53C7 20FC 53C9 010060	00134 00135	JR LD	NZ,READ2 BC,BUFFER	;WAIT FOR NOT BUSY ;BC HAS BUFFER ADDR
53CC 11EF37 53CF AF	00136 00137	LD XOR	DE, DATARG	, JULIUN NUUK
53DØ 32EE37 53D3 368C	00138 00139 READ3	LD	(SECTOR),A	START AT SECTOR #
53D5 E5	88148	LD PUSH	(HL),8CH	;READ SECTOR ;WASTE TIME
53D6 E1 53D7 E5	00141 00142	POP PUSH	HL HL	
53D8 E1 53D9 1883	00143 00144	POP JR	HL READ5	
53DB 0F 53DC 300A	00145 READ4 00146	RRCA JR	NC,READ6	;TEST BUSY BIT ;NOT BUSY - DONE OR ERROR
53DE 7E 53DF CB4F	00147 READ5 00148	LD	A, (HL)	GET STATUS WORD
53El 28F8	00149	BIT JR	l,A Z,READ4	TEST FOR "DRQ"-DATA REQ
53E3 1A 53E4 02	00150 00151	LD LD	A,(DE) (BC),A	;DRQ - GET NEXT BYTE ;STORE BYTE
53E5 Ø3 53E6 18F6	00152 00153	INC JR	BC READ5	GO FOR MORE
53E8 7E 53E9 E61C	00154 READ6 00155	LD AND	A,(HL) 1CH	FDC STATUS WORD TEST FOR REC NOT FND,
53EB 2889 53ED 211957	00156 00157	JR LD	Z,READ7	CRC ERR, LOST DATA
53F0 CD3956	00158	CALL	HL,DIRERR OUTSTR	;DIRECTORY READ ERROR
53F3 C3EE55 53F6 3AEE37	00159 00160 READ7	JP LD	DOSEXT A, (SECTOR)	GET CURRENT SECTOR NR
53F9 3C 53FA 32EE37	00161 00162	INC LD	A (SECTOR),A	;UPDATE IT
				Listing continues

# THE

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Listing continued 53FD FEØA 00163 \*TEST FOR FULL TRACK READ 53FF 20D2 00164 NZ.READ3 THE DIRECTORY HAS BEEN READ TO THE BUFFER AND NOW READ THROUGH THE "GAT" SECTOR (SECTOR  $\emptyset$ ) AND SET UP THE 00166 00167 00168 TITLE LINE FOR THE SCREEN. 00169 5401 010800 00170 BC,8 DE,DKNAME :BYTE COUNT FOR NAME 5404 11D556 5407 21D060 00171 LD 99172 LD HL, GAT+0D0H :START OF DISK NAME 540A EDBØ 00173 LDIR 540C 010800 540F 21D860 LD :LENGTH OF DATE 99175 LD HL,GAT+ØD8H START OF CREATION DATE 5412 11DF56 00176 a.1DE, DATE 5415 EDBØ 5417 ØEØØ 00177 LDIR LD 99178 : COUNT TRACKS LOCKED OUT 5419 0628 B, NRTRKS 541B 216060 541E 7E 00180 HL,GAT+60H START OF TRK LOCKED OUT 00181 TRKS LD A, (HL) 541F FEFC 00182 CP ØFCH ; CODE FOR NOT LOCKED OUT 5421 2801 00183 Z,TRKS2 00184 TNC 5424 23 00185 TRKS2 HL 5425 10F7 99186 DJNZ TRKS ;LOOP FOR FULL DISK WORTH 5427 69 00187 L,C H,B LD; SET UP CONVERSION 5428 60 00188 : H=0 5429 CD9AØA ; (HL) -->4121H, 2-->40AFH ; CONVERT NUMBER TO STRING 00189 CALL HLACC 00190 CALL CVTASC 542F 23 00191 SKIP LEADING BLANK HL 5430 7E A, (HL) DE, TLO 00192 LD LD GET FIRST DIGIT 5431 110857 5434 12 00194 (DE),A ;STORE IN HEADING 00195 INC HT. 5436 13 5437 7E 00196 INC DE 00197 LD A, (HL) GET NEXT DIGIT 5438 B7 99198 OR ; TEST FOR TERMINATION 00199 Z.TRKS3 JR 543R 12 00200 (DE),A 543C ØEØØ 00201 TRKS3 LD ; COUNT OF FREE GRANULES 00202 B, NRTRKS L.D 5440 210060 00203 LD HL GAT ;START OF GRAN ALLOC TBL ;GET NEXT BYTE 5443 7E 00204 GRANS0 LD 5444 FEFC 00205 ØFCH CP BOTH FREE GRANS 5446 2004 00206 00207 NZ,GRANS1 5448 ØC TNC 5449 ØC 00208 INC 544A 180C 00209 JR GRANS3 544C FEFD 00210 GRANS1 CP ØFDH ; CODE FOR ONE FREE 544E 2003 00211 NZ,GRANS2 5450 0C 00212 INC 5451 1805 00213 GRANS3 JR 00214 GRANS2 00215 5453 FEFE ØFEH ; CODE FOR THE OTHER FREE 5455 2001 JR. NZ, GRANS3 5457 ØC 00216 INC 5458 23 00217 GRANS3 :BUMP POINTER 5459 10E8 00218 DJNZ GRANSØ ;LOOP FOR FULL DISK 545B 69 00219 LD L.C ;SET UP CONVERSION 545C 60 00220 H.B : H = Ø 545D CD9AØA 00221 CALL HLACC ; (HL) --> BASIC ACCUM 5460 CDBD0F 00222 CALL CVTASC CONVERT TO STRING 5463 23 00223 5464 11F456 00224 DE, GRANS LD 5467 7E 5468 12 5467 00225 LD A, (HL) :GET FIRST DIGIT 00226 LD (DE),A 5469 23 00227 INC HL 546A 13 00228 INC DE 546B 00229 LD A, (HL) :GET NEXT DIGIT 546C B7 00230 OR ; TEST FOR TERMINATOR 546D 2801 00231 JR Z,GRANS4 00232 I.D (DE),A 00233 00234 ; ZERO MAP ARRAY AND VARIOUS VARIABLES 00235 5470 214658 5473 114758 00236 GRANS4 LD HL, MAP ; SET UP MAP STRING ARRAY 00237 LD DE,MAP+1 00238 I.D BC,1039 ; COUNT FOR 13\*80 ARRAY 5479 3600 00239 LD (HL),0 ; PROPOGATION CHARACTER 547B EDBØ 00240 LDIR 547D AF XOR 547E 323657 00242 00243 (PAGES),A 5481 32D157 LD 00244 START TO BUILD THE MAP STRING ARRAY OF FILESPEC'S AT THE LOCATION CORRESPONDING TO THE LOCATION OF THE FILE ON THE DISKETTE. THIS IS DONE BY LOOKING AT THE FIRST BYTE OF EACH FILE DIRECTORY ENTRY (FDE) STARTING WITH THE SECOND SECTOR OF THE DIRECTORY. IF IT IS 0 (WHICH 00245 00246 00247 00248 BYTE OF EACH FILE DIRECTORY ENTRY (FDE) STARTING WITH THE SECOND SECTOR OF THE DIRECTORY. IF IT IS 0 (WHICH MEANS THE FDE IS EMPTY) OR 90H (WHICH MEANS THAT THE FDE IS REALLY A FILE EXTENSION DIRECTORY ENTRY (FXDE) OF AN ALREADY EXISTING FPDE) THEN IGNORE IT. LOOK AT THE FDE ENTRIES FOR ALL THE REST AS THEY ARE THE FILE PRIMARY DIRECTORY ENTRIES (FPDE). UTILIZE THE "EXTENT" INFORMATION IN EACH FPDE (AND CORRESPONDING FXDE, IF NECESSARY) TO STORE THE FILESPEC IN THE MAP TABLE IN THE LOCATIONS CORRESPONDING TO TRACK/ASSIGNED GRANULES 00250 00251 00253 00254 00256 00257 THE LOCATIONS CORRESPONDING TO TRACK/ASSIGNED GRANULES 00258 00259 5484 210062 HL, FDES ;START OF FDE'S IN BUFFER ;SAVE POINTER ON STACK 00260 SCAN PUSH 5488 7E 00261 LD A,(HL) ;GET BIT RECORD OF FDE Listing continues

Listing continued				
5489 B7	00262	OR	A	; TEST FOR NULL
548A 2857 548C PE90	00263 00264	JR CP	Z.SCNNXT 90H	TEST POR PXDE ENTRY
548E 2853 5498 CD4256	00265 80266	JR CALL	Z,SCNNXT FLSPEC	BUILD FILESPEC TO FILENM
5493 DDE1 5495 DDE5	60267 80268	POP PUSH	IX IX	FDE POINTER
5497 Ø11600 549A DDØ9	00269 SCAN1 00270	LD ADD	BC,22 IX,BC	;OFFSET OF EXTENT #1
549C DD7E08 549F PEPP	00271 00272	LD CP	A,(IX) OPPH	GET TRACK # ;TEST FOR END OF XTHT
54A1 2849 54A3 CD0856	00273 00274	JR CALL	Z,SCNNXT STORIT	STORE PILESPEC
54A6 DD23 54A8 DD23	00275 00276	INC	IX IX	, 520M2 1 2002 00
54AA DD7EØØ 54AD PEPP	00277 00278	LD	A, (IX)	TRACK FOR EXTENT #2
54AF 2832 54B1 CD0856	00279 00280	JR	9FPH 2,SCNNXT	; TEST FOR END
54B4 DD23	00281	CALL INC	STORIT IX	
54B6 DD23 54B8 DD7E98	00282 00283	INC LD	IX A,(IX)	;TRACK POR EXTENT #3
54BB FEFF 54BD 2824	00284 00285	CP JR	ØPFH Z,SCNNXT	
54BF CD0856 54C2 DD23	00286 00287	CALL INC	STORIT IX	
54C4 DD23 54C6 DD7E00	##288 ##289	INC LD	IX A,(IX)	TRACK FOR EXTENT 44
54C9 FEFF 54CB 2016	00290 00291	CP JR	0FFH 2,SCNNXT	7-14101 101 241211 44
54CD CD#856 54D# DD23	00292	CALL	STORIT	
54D2 DD23	00293 00294	INC	IX IX	
54D4 DD7E00 54D7 FEFF	00295 00296	CP CP	A,(IX) Offh	;TRACK FOR EXTENT\$5 ;TEST FOR END OF EXTENTS
54D9 2888 54DB PEFE	00297 00298	JR CP	z, scnnxt øpeh	TEST FOR PADE ENTRY NEXT
54DD CAF255 54EØ CDØ856	00299 80300	JP CALL	Z,FXDE STORIT	; PROCESS IT
54E3 E1 54E4 012000	88381 SCNNXT 88382	POP LD	HL BC,32	GET POINTER TO PDE LENGTH OF ONE PDE
54E7 Ø9 54E8 3E6A	89393 89394	ADD LD	HL,BC	; BUMP POINTER (-8 ; TEST FOR END OF BUFFER
54EA BC 54EB 209A	00305 00306	CP JR	H N2,SCAN	,
5102 2531	88387			EN CONSTRUCTED, DISPLAY
	00309 ; THE 00310 ; TEN	DISK GRA	NULE MAP ON THE V	VIDEO IN FOUR PAGES OF BADER AT TOP EACH TIME.
54ED CDC901	00311 00312 DISP	CALL	CLS	CLEAR THE SCREEN
54FØ 21163C				,
54F3 222040	00313 00314	LD LD	HL, VIDEO+22 (CURSOR), HL	START OF TITLE
54F3 222040 54F6 217B56	00314 00315	LD LD	(CURSOR), HL HL, TITLE	START OF TITLE
54F3 222848 54F6 217B56 54F9 CD3956 54FC 21CB56 54FF CD3956 5582 21913C	00314 00315 00316 00317 00318 00319	LD CALL LD CALL LD	(CURSOR), HL HL, TITLE OUTSTR HL, DEMSG OUTSTR HL, VIDEO+145	START OF TITLE
54F3 222848 54F6 217B56 54F9 CD3956 54FC 21CB56 54FF CD3956 5582 21913C 5585 222848 5588 21D557	00314 00315 00316 00317 00318 00319 00320	LD CALL LD CALL LD LD LD LD	(CURSOR), HL HL, TITLE OUTSTR HL, DRMSG OUTSTR HL, VIDEO+145 (CURSOR), HL HL, LINE3	;START OF TITLE ;TITLE LINE ;DRIVE,NAME,DATE,ETC.
54F3 222040 54F6 217B56 54F9 CD3956 54FC 21CB56 54FC CD3956 55F2 21913C 5595 222040 5598 21D557 5598 CD3956 5598 21D13C	68314 68315 68316 68317 68318 98319 98328 88321 88322	LD CALL LD CAL	(CURSOR), HL HL,TITLE OUTSTR HL,DKMSG OUTSTR HL,VIDEO+145 (CURSOR), HL HL,LINE3 OUTSTR HL,VIDEO+289	;START OF TITLE ;TITLE LINE ;DRIVE,NAME,DATE,ETC.
54F3 222046 54F6 217B56 54F9 CD3956 54FC 21CB56 55FE 21913C 5595 222040 5598 21D557 559B CD3956 559E 21D13C 5511 11D23C 5511 4012E08	68314 68315 68316 68317 68318 68319 68329 68321 88322 88324 88324	LD CALL LD LD LD CALL LD L	(CURSOR), HL HL, TITLE OUTSTR HL, DKMSG OUTSTR HL, VIDEO+145 (CURSOR), HL HL, LINE3 OUTSTR HL, VIDEO+289 DE, VIDEO+218 BC, 46	;START OF TITLE ;TITLE LINE ;DRIVE, NAME, DATE, ETC. ;START OF GRANULE MAP ;START OF LINE4
54F3 222040 54F6 217B56 54FC 033956 54FC 033956 55FC 210B56 55FS 222040 55BS 21913C 55BS 21913C 55BS 210557 55BB C103956 55BB 21013C 5511 11023C 5514 012E00 5514 012E00 5517 368C	68314 68315 68316 68317 68318 68319 68320 88321 88322 88322 68325 68325	LD LD CALL LD CALL LD L	(CURSOR), HL HL, TITLE OUTSTR HL, DKMSG OUTSTR HL, VIDEO+145 (CURSOR), HL HL, LINE3 OUTSTR HL, VIDEO+289 DE, VIDEO+218 BC, 46 (HL), 148	;START OF TITLE ;TITLE LINE ;DRIVE,NAME,DATE,ETC. ;START OF GRANULE MAP ;START OF LINE4 ;GRAPHICS BLOCK ;DRAW LINE
54F3 222046 54F6 217B56 54F9 CD3956 54FP CD3956 55F2 21913C 5508 210557 5508 210557 5508 21013C 5511 11023C 5511 41220 5517 368C 5519 EDB6 5519 EDB6 5519 32D13C	88314 68315 68316 68317 68319 88328 88322 88322 88322 88324	LD LD CALL LD CALL LD	(CURSOR), HL HL, TITLE OUTSTR HL, DKMSG OUTSTR HL, VIDEO+145 (CURSOR), HL HL, LINE3 OUTSTR HL, VIDEO+289 DE, VIDEO+218 BC, 46	; START OF TITLE ; TITLE LINE ; DRIVE, NAME, DATE, ETC. ; START OF GRANULE MAP ; START OF LINE4 ; GRAPHICS BLOCK
54F3 222046 54F6 217B56 54F9 CD3956 54FC 21CB56 55F2 21913C 5595 222940 5598 21D557 5598 CD3956 559E 21D13C 5511 11D23C 5511 11D23C 5514 012E09 5517 36BC 5519 EDB6 5518 3EBF 551D 32D13C 5528 32EB3C 5523 32F33C	88314 88315 88316 88317 88318 88321 88321 88322 88322 88324 88325 68327 68327 68328	LD LD CALL LD CALL LD LD CALL LD L	(CURSOR), HL HL, TITLE OUTSTR HL, DKMSG OUTSTR HL, VIDEO+145 (CURSOR), HL HL, LINE3 OUTSTR HL, VIDEO+289 DE, VIDEO+218 BC, 46 (HL), 148 A, 191 (VIDEO+289), A (VIDEO+232), A	; START OF TITLE ; TITLE LINE ; DRIVE, NAME, DATE, ETC. ; START OF GRANULE MAP ; START OF LINE4 ; GRAPHICS BLOCK ; DRAW LINE ; GRAPHICS BLOCK
54F3 222040 54F6 217B56 54F6 CD3956 54FC CD3956 55FC 21913C 5595 222940 5598 210557 5598 CD3956 5511 11023C 5511 11023C 5511 612600 5517 368C 5518 22050 5518 3288 5518 3283C	88314 68315 68316 68317 68319 88328 88321 88322 88322 88324 68325 68327 68329 88339	LD LD CALL LD L	(CURSOR), HL HL, TITLE OUTSTR HL, DKMSG OUTSTR HL, VIDEO+145 (CURSOR), HL HL, LINE3 OUTSTR HL, VIDEO+289 DE, VIDEO+218 BC, 46 (HL), 148 A, 191 (VIDEO+289), A (VIDEO+232), A (VIDEO+255), A A, 18	;START OF TITLE ;TITLE LINE ;DRIVE, NAME, DATE, ETC. ;START OF GRANULE MAP ;START OF LINE4 ;GRAPHICS BLOCK ;DRAW LINE ;GRAPHICS BLOCK ;DIVIDE COLUMNS ;NUMBER OF "LINEN"'S
54F3 222046 54F6 217B56 54F9 CD3956 54FC 21CB56 54FF CD3956 55E2 21913C 55B5 222040 55B8 CD3956 55BE 21D13C 5511 11D23C 5511 11D23C 5514 012E09 5517 36BC 5518 3EBP 551B 3EBP 551D 32D13C 5520 32E83C 5520 32E83C 5528 31808D 5528 11003D	68314 68315 68316 68317 68318 68329 68321 98322 68323 68324 68325 68326 68327 68327 68328 68329 88331 88331	LD LD CALL LD L	(CURSOR), HL HL, TITLE OUTSTR HL, DKMSG OUTSTR HL, VIDEO+145 (CURSOR), HL HE, LINE3 OUTSTR HL, VIDEO+289 DE, VIDEO+218 BC, 46 (HL), 148 A, 191 (VIDEO+289), A (VIDEO+255), A A, 18 DE, VIDEO+256 BC, 64	; START OF TITLE ; TITLE LINE ; DRIVE, NAME, DATE, ETC. ; START OF GRANULE MAP ; START OF LINE4 ; GRAPHICS BLOCK ; DRAW LINE ; GRAPHICS BLOCK ; DIVIDE COLUMNS
54F3 222040 54F6 217B56 54F9 CD3956 54FC 21CB56 54FF CD3956 5562 21913C 5595 222040 5598 21D557 5598 CD3956 5511 11D23C 5511 412200 5511 36BC 5519 EDB0 5513 32D13C 5520 32E83C 5523 32F73C 5528 11803D 5528 11803D 5528 21058	66314 66315 66317 66317 66319 66329 66321 66323 66324 66325 66326 66327 66328 66329 66331 66331 66333 66331	LD LD CALL LD L	(CURSOR), HL HL, TITLE OUTSTR HL, DKMSG OUTSTR HL, VIDEO+145 (CURSOR), HL HB, LINE3 OUTSTR HL, VIDEO+289 DE, VIDEO+218 BC, 46 (HL), 148 A, 191 (VIDEO+289), A (VIDEO+232), A (VIDEO+255), A A, 18 DE, VIDEO+256 BC, 64 HL, LINEN	;START OF TITLE ;TITLE LINE ;DRIVE,NAME,DATE,ETC. ;START OF GRANULE MAP ;START OF LINE4 ;GRAPHICS BLOCK ;DRAN LINE ;GRAPHICS BLOCK ;DIVIDE COLUMNS ;NUMBER OF "LINEN"'S ;START OF DISPLAY ;BTTE COUNT ;WRITE ONE LINE
54F3 222846 54F6 217B56 54F9 CD3956 54FC 21CB56 55FC 21913C 5598 21D13C 5598 21D13C 5511 11D23C 5511 4012E08 5512 EDB6 5513 32B3C 5514 32B3C 5514 32B3C 5515 32B3C 5528 31B3D 5528 31B8D 5528 31B8D 5531 EDB8 5531 EDB8	68314 68315 68317 68318 68319 68329 68321 68322 68323 68325 68325 68326 68327 68331 88331 88333 88334 DISP1 68335 68335	LD LD CALL LD L	(CURSOR), HL HL, TITLE OUTSTR HL, DKMSG OUTSTR HL, VIDEO+145 (CURSOR), HL HL, LINE3 OUTSTR HL, VIDEO+289 DE, VIDEO+218 BC, 46 (HL), 148 A, 191 (VIDEO+289), A (VIDEO+289), A (VIDEO+255), A A, 18 DE, VIDEO+256 BC, 64 HL, LINEN ANI, DISP1	; START OF TITLE ; TITLE LINE ; DRIVE, NAME, DATE, ETC. ; START OF GRANULE MAP ; START OF LINE4 ; GRAPHICS BLOCK ; DRAW LINE ; GRAPHICS BLOCK ; DIVIDE COLUMNS ; NUMBER OF "LINEN"'S ; START OF DISPLAY ; BYTE COUNT ; WRITE OME LINE ; TEST FOR END
54F3 222046 54F6 217B56 54F9 CD3956 54FC 21CB56 54FF CD3956 55F2 21913C 55B5 222040 55B8 21D557 55BB CD3956 55BE 21D13C 5511 11D23C 5511 11D23C 5514 012E09 5517 36BC 5518 3EBP 5510 32D13C 5520 32E83C 5523 32F33C 5528 31880 5528 11883 5528 11883 5531 EDB6 5531 EDB6 5531 EDB6 5531 EDB6 5533 3D 5534 28F5 5534 28F5 5536 21913F	68314 68315 68316 68317 68318 68329 68321 88322 68322 68323 68326 68327 68328 68327 68328 68334 88334 88334 88334 88334 88334 88337 88336 88336 88336	LD LD CALL LD L	(CURSOR), HL HL, TITLE OUTSTR HL, DKMSG OUTSTR HL, VIDEO+145 (CURSOR), HL HE, LINE3 OUTSTR HL, VIDEO+289 DE, VIDEO+218 BC, 46 (HL), 146  A, 191 (VIDEO+289), A (VIDEO+255), A A, 18 DE, VIDEO+256 BC, 64 HL, LINEN A NZ, DISP1 HL, VIDEO+913 DE, VIDEO+914	;START OF TITLE ;TITLE LINE ;DRIVE,NAME,DATE,ETC. ;START OF GRANULE MAP ;START OF LINE4 ;GRAPHICS BLOCK ;DRAN LINE ;GRAPHICS BLOCK ;DIVIDE COLUMNS ;NUMBER OF "LINEN"'S ;START OF DISPLAY ;BTTE COUNT ;WRITE ONE LINE
54F3 222046 54F6 217B56 54F9 CD3956 54FC 21CB56 54FF CD3956 55F2 21913C 55B5 222840 55B8 CD3956 55B8 CD3956 55B8 CD3956 55B1 11D23C 5511 11D23C 5514 012E08 5517 36BC 5518 3EBP 5510 32D13C 5528 32E83C 5528 31E83B 5528 11083D 5528 219558 5531 2DB6 5531 3DB6 5531 3DB7 5534 28F5 5531 2DB7 5533 3D 5534 28F5 5531 2DB8 5531 3DB8 5531 2DB8 5531 3DB8 5531 2DB8 5531 3DB8	66314 66315 66317 66317 66319 66329 66322 66322 66322 66325 66326 66327 66328 66327 66328 66332 66332 66333 66333 66333 66333 66333 66333 66333 66333 66333 66334 66333 66334 66334	LD LD CALL LD L	(CURSOR), HL HL, TITLE OUTSTR HL, DKMSG OUTSTR HL, VIDEO+145 (CURSOR), HL HB, LINE3 OUTSTR HL, VIDEO+289 DE, VIDEO+218 BC, 46 (HL), 148 A, 191 (VIDEO+289), A (VIDEO+232), A (VIDEO+255), A A, 18 DE, VIDEO+256 BC, 64 HL, LINEN A NZ, DISP1 HL, VIDEO+913	; START OF TITLE ; TITLE LINE ; DRIVE, NAME, DATE, ETC. ; START OF GRANULE MAP ; START OF LINE4 ; GRAPHICS BLOCK ; DRAW LINE ; GRAPHICS BLOCK ; DIVIDE COLUMNS ; NUMBER OF "LINEN"'S ; START OF DISPLAY ; BYTE COUNT ; WRITE OME LINE ; TEST FOR END
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54F3 222846 54F6 217B56 54F6 217B56 54FC 210B56 54FC 033956 55FC 21913C 5588 210557 5588 210557 5588 C03956 5582 21013C 5511 11023C 5511 11023C 5511 368C 5519 EDB6 5518 32B13C 5528 32883C 5523 32F3C 5528 11883D 5528 11883D 5528 11883D 5528 219558 5531 EDB8 5533 3PF3C 5528 219558 5531 EDB8 5533 3PF3C 5528 11883D 5528 11883D 5528 11883D 5528 11883D 5531 EDB8 5533 3D 5528 11883D 5531 EDB8 5534 28F5 5536 21913F 5536 21913F 5536 21913F 5536 21913F 5536 21913F 5536 21913F 5537 3663 5541 EDB8	68314 68315 68316 68317 68319 68321 68322 68322 68323 68325 68325 68326 68327 68334 68335 68335 68334 68335 68336 68346 68346 68346 68347 68348 68347 68348 68347 68348 68347 68348 68347 68348 68347 68348 68347 68348 68346 68347 68348 68347 68348 68347 68348 68347 68348 68348 68348 68347 68348 6838 683	LD LD CALL LD L	(CURSOR), HL HL, TITLE OUTSTR HL, DKMSG OUTSTR HL, VIDEO+145 (CURSOR), HL HL, LINE3 OUTSTR HL, VIDEO+289 DE, VIDEO+218 BC, 46 (HL), 148 A, 191 (VIDEO+289), A (VIDEO+289), A (VIDEO+255), A A, 18 DE, VIDEO+256 BC, 64 HL, LINEN A N3, DISP1 HL, VIDEO+913 DE, VIDEO+914 BC, 46 (HL), 131  RMATTED, NOW WRITO THE FORMATTED S HL, (PAGES) HL BC	; START OF TITLE ; TITLE LINE ; DRIVE, NAME, DATE, ETC. ; START OF GRANULE MAP ; START OF LINE4 ; GRAPHICS BLOCK ; DRAW LINE ; GRAPHICS BLOCK ; DIVIDE COLUMNS ; NUMBER OF "LINEN"'S ; START OF DISPLAY ; BYTE COUNT ; WRITE ONE LINE ; TEST FOR END ; BOTTOM LINE ; LINE BLOCK SEE 16 TRACKS WORTH OF SCREEN
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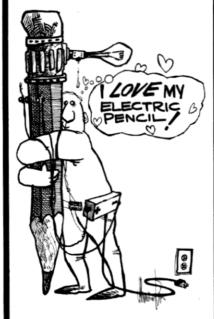
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Listing continued				
555B D1	00361	POP	DE HT	GET TRK NR FOR INDEX
555C EB 555D 29	00362 00363	EX ADD	DE,HL HL,HL	;DE=PTR TO STRING, HL=TRK ;*2
555E 29	00364	ADD	HL,HL	;*4
555F 29 5560 29	00365 00366	ADD ADD	HL,HL HL,HL	;*8 ;*16
5561 29 5562 29	00367 00368	ADD	HL,HL	;*32
5563 010D3D	00369	ADD LD		;*64 ;BASE FOR TRACK NUMBER
5566 Ø9 5567 E5	00370 00371	ADD PUSH	HL,BC	
5568 1A	00372 DIS	P2 LD	A, (DE)	GET STRING VALUE
5569 B7 556A 2805	00373 00374	OR JR	A Z,DISP3	; TEST FOR 0 BYTE TERMINAL
556C 77 556D 13	00375 00376	LD	(HL),A	
556E 23	00377	INC	DE HL	
556F 18F7	00378 00379	JR	DISP2	
5571 2AD357 5574 29	00380 DISI		HL, (TRKNR)	GET TRACK NR AS INDEX
5575 E5	00381 00382	ADD PUSH	HL,HL HL	; DOUBLE TO GET GRANULE
5576 D1 5577 29	00383 00384	POP ADD	DE HL,HL	;*2
5578 19	00385	ADD	HL,DE	;*3
5579 29 557A 29	00386 00387	ADD ADD	HL,HL HL,HL	;*6 ;*12
557B 19 557C 11465B	00388	ADD	HL,DE	;*13
557F 19	00389 00390	LD ADD	DE,MAP HL,DE	;BASE ADDRESS ;BASE+GRANULE*13
5580 D1 5581 D5	00391 00392	POP	DE DE	;LINE ADDR ;KEEP IT
5582 E5 5583 EB	00393	PUSH	HL	; KEEP IT ; SAVE MAP ARRAY ADDR
5584 010A00	00394 00395	EX LD	DE,HL BC,10	;TAB OVER TO FILESPEC
5587 <b>09</b> 5588 1A	00396 00397 DISI	ADD	HL,BC A,(DE)	GET NEXT FILE CH
5589 B7	00398	OR	A	; TEST FOR Ø TERMINAL
558A 28Ø5 558C 77	00399 00400	JR LD	Z,DISP4 (HL),A	;STORE IT IN LINE
558D 13 558E 23	00401 00402	INC INC	DE HL	<del>-</del>
558F 18F7	00403	JR	DISP30	. Map mo com
5591 012100 5594 D1	00404 DISI 00405	P4 LD POP	BC,33 DE	;TAB TO 2ND GRAN ON LINE ;STRING ARRAY ADDRESS
5595 E1 5596 Ø9	00406 00407	POP ADD	HL	; LINE ADDRESS
5597 EB	00408	EX	HL,BC DE,HL	
5598 010D00 559B 09	00409 00410	LD ADD	BC,13 HL,BC	;BASE+13*(GRANULE+1)
559C 7E	00411 DIS	P5 LD	A, (HL)	GET FILESPEC NEXT CH
559D B7 559E 2805	00412 00413	OR JR	A Z,DISP6	; TEST FOR TERMINAL
55AØ 12 55A1 23	00414 00415	LD INC	(DE),A	
55A2 13	00416	INC	DE	
55A3 18F7 55A5 3AD157	00417 00418 DISI		DISP5 A,(TRK)	; INCR CURRENT TRK ON PAGE
55A8 3C 55A9 32D157	00419 00420	INC LD	A (TRK),A	
55AC FEØA	00421	CP	10	TEST FOR 10 THIS PAGE
55AE 2093 55B0 3A3657	00422 00423	JR LD	NZ,DISPØ A,(PAGES)	;FILL UP SCREEN
55B3 3C 55B4 323657	00424 00425	INC LD	A (PAGES),A	;UPDATE CURRENT PAGE
55B7 FE <b>04</b>	00426	CP	4	; TEST FOR ALL DONE
55B9 2816 55BB 21D63F	00427 00428	JR LD	Z,EXIT HL,VIDEO+982	
55BE 222040	00429	LD	(CURSOR),HL	
55C1 217A57 55C4 CD3956	00430 00431	LD CALL	HL, PRMPT1 OUTSTR	
55C7 CD4900 55CA AF	00432 00433	CALL	GETKEY A	; ZERO LOCAL PAGE TRK CNT
55CB 32D157 55CE C3ED54	00434 00435	LD JP	(TRK),A	
	00436		DISP	; DISPLAY NEXT 10 TRACKS
55D1 21D13F 55D4 222040	00437 EXIS	T LD LD	HL, VIDEO+977 (CURSOR), HL	
55D7 21A257	00439	LD	HL,PRMPT2	
55DA CD3956 55DD CD4900	00440 00441	CALL CALL	OUTSTR GETKEY	
55EØ FE4Ø 55E2 200A	00442 00443	CP JR	NZ,DOSEXT	; CHECK FOR DISPLAY AGAIN ; NO - EXIT
55E4 AF	00444	XOR	A	
55E5 323657 55E8 32D157	00445 00446	LD LD	(PAGES),A (TRK),A	; RESET POINTERS
55EB C3ED54 55EE FB	00447 00448 DOSI	JP	DISP	; REDISPLAY THE MAP
55EE FB 55EF C32D40	00449	EXT EI JP	DOS	
	00452 ; IX 00453 ; WX 00454 ; TX 00455 ; TX 00456 ; 00457 ;	X REGISTER T ILL CORRESPO HE INFORMATI HE EXTENT, E X'FE'=E X'44'=0	TO THE CORRECT LOWN TO THE FXDE LOWN IS EXTRACTED IN FE 44" IS REMIXTENT POINTS TO IN 10 00 1000	FXDE
	00458; 00459; 00460;	THE 1ST DIRECTO	3 BITS IS THE LOOKY SECTOR IDENTI	OCATION OF THE FXDE IN THE FIED BY THE LAST 3 BITS. IN 2*20H=40H ENTRY IN
				Listing continues

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OTHER VENTURE #5-	0 15.00	UPPER REACHES OF			D 48K I & III		23.00
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### ### ### ### ### ### ### ### ### ##	Listing continued					
STATE						
Sept			;	THIS IS	THE 4TH SECTOR	PROM THE "HIT" SECTOR)
SSPP   C682   84466			FXDE			
Sept	55P7 C682	88466		ADD	A,2	OFFSET COUNT
155FP   156FB   16465	55FB 67					CORRECT FOR MEM ADDR
See					A, (IX+1)	
See	5601 6F	88471		LD		STRIP OFF ENTRY LOC
See   1975   1964   197   198   19						;SET UP ADDR IN IX
## 176   SURBOUTINE GTORITY USES THE TRACK NUMBER IN (A), THE   ## 171   ## 175		88474				;BACK IN BUSINESS
## 17   CANNULE HUMBER WHICH IS BIT 5 OF THE SECOND BYTE OF ## 2500 BYTE   ## 250			; SUBRO	UTINE <s< th=""><th>TORIT&gt; USES THE</th><th>TRACK NUMBER IN (A). THE</th></s<>	TORIT> USES THE	TRACK NUMBER IN (A). THE
		00477	; GRANU	LE NUMBE	R WHICH IS BIT 5	OF THE SECOND BYTE OF
SAME   STORIT   D		00479	; IN <f< th=""><th>ILENM&gt; I</th><th>N THE NUMBER OF</th><th>CONTIGUOUS ENTRIES IN MAP</th></f<>	ILENM> I	N THE NUMBER OF	CONTIGUOUS ENTRIES IN MAP
		00480 00481	; ACCOR	DING TO E EXTENT	THE LOW ORDER 5	BITS IN THE SECOND BYTE
See   2689   2689   268465   ADD   HL, HL   1, 22 = GRANULE NUMBER   1, 2667 CBSF   26847   BIT   5, A   17EST FOR GRANULE 0/1   1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,	5688 SP	00482				
See Code	5609 2600	00484	BIORII	LD		FIRACK NR TO HL
Seff Case						
Select   S		00487		BIT	5,A	TEST FOR GRANULE 0/1
Select   S	5613 23					COMPUTED GRANULE NUMBER
5618 CD1E56 5618 CD1E56 5618 SPFB 5610 CS 5618 CS 5618 SPFB 5610 CS 5618 CS 5618 SPFB 5610 CS 5618 CS 5618 CS 5618 CS 5619 CS 5610 CS			STOR1			
Soid Corner		00492		LD	B,A	
08496	561B 10FB	88494	STURZ			; MOVE FILESPEC
04497   SUBROUTINE (ANOVEIT) IS USED TO MOVE THE FILESPEC     04499   TO BY THE HL REGISTER (WHICH IS TAKEN AS A GRANULE     04590   NUMBER TO INDEX THE (MAP) ARRAY	561D C9			RET		
### ### ### ### ### ### ### ### ### ##		00497	; SUBRO	UTINE <m< th=""><th>OVEIT&gt; IS USED TO</th><th>O MOVE THE FILESPEC</th></m<>	OVEIT> IS USED TO	O MOVE THE FILESPEC
		00498	; CONTA	THE HL	<pre><filenm> TO THE REGISTER (WHICH)</filenm></pre>	13 BYTE VECTOR POINTED IS TAKEN AS A GRANULE
Soli Di		00500	; NUMBE	R TO IND	EX THE (MAP) ARR	AY)
Section   Sect		00502	MOVEIT			
Second   S						SAVE POINTER ON STACK
5622 29		00505		ADD	HL, HL	; INDEX*2
5622 19 68599 ADD HL,DE ; INDEX*13 5626 114658 6818 LD DE MAP 5627 19 68518 LD DE MAP 5628 118857 68512 LD DE MAP 5628 10857 68512 LD DE FILENM 5628 7 68513 MOV LD A (DE) ; MOVE CHARACTER 5628 7 68513 MOV LD A (DE) ; MOVE CHARACTER 5628 87 68515 JR 7,0001 ; EXIT ON 8 TERMINAL 5628 87 68515 JR 7,0001 ; EXIT ON 8 TERMINAL 5628 87 68516 LD (HL), A 5629 2885 68515 JR 7,0001 ; EXIT ON 8 TERMINAL 5631 13 88518 INC DE 5631 13 88518 INC DE 5632 13 88521 INC DE 5633 13 88528 MOV1 POP HL ; RESTORE POINTER 5632 23 88521 ; SUBROUTINE COUTSTR> COPIES THE INPUT STRING TO THE 88528 ; SUBROUTINE COUTSTR> COPIES THE INPUT STRING TO THE 88528 ; SUBROUTINE COUTSTR> COPIES THE INPUT STRING TO THE 88528 ; SUBROUTINE COUTSTR> COPIES THE INPUT STRING TO THE 88528 ; SUBROUTINE COUTSTR> COPIES THE INPUT STRING TO THE 88528 ; SUBROUTINE COUTSTR> COPIES THE INPUT STRING TO THE 88528 ; SUBROUTINE COUTSTR> COPIES THE INPUT STRING TO THE 88528 ; SUBROUTINE COUTSTR> COPIES THE INPUT STRING TO THE 88528 ; SUBROUTINE COUTSTR> COPIES THE INPUT STRING TO THE 88528 ; SUBROUTINE COUTSTR> COPIES THE INPUT STRING TO THE 88528 ; SUBROUTINE COUTSTR> COPIES THE INPUT STRING TO THE 88528 ; SUBROUTINE COUTSTR> COPIES THE INPUT STRING TO THE 88528 ; SUBROUTINE COUTSTR> COPIES THE INPUT STRING TO THE 88528 ; SUBROUTINE COUTSTR> COPIES THE INPUT STRING TO THE 88528 ; SUBROUTINE COUTSTR> COPIES THE INPUT STRING TO THE 88528 ; SUBROUTINE COUTSTR> COPIES THE INPUT STRING TO THE 88528 ; SUBROUTINE COUTSTR> COPIES THE INPUT STRING TO THE 88528 ; SUBROUTINE COUTSTR> COPIES THE INPUT STRING TO THE 88528 ; SUBROUTINE COUTSTR> COPIES THE INPUT STRING TO THE 88529 ; FILENDA AND THE HIDDER TO THE THE POPE IN THE 88529 ; FILENDA AND TERMINATING WITH A 8 BYTE 88529 ; FILENDA AND TERMINATING WITH A 8 BYTE 88529 ; FILENDA AND TERMINATING WITH A 8 BYTE 88529 ; FILENDA AND TERMINATING WITH A 8 BYTE 88529 ; FILENDA AND TERMINATING WITH A 8 BYTE 88520 ; FILENDA AND TERMINATING WITH A 8 BYTE 88520 ; FILENDA AND TERMINATING WITH A 8 BYTE 88520 ; FILENDA AND TERMINATING WITH A 8	5623 29	00507		ADD		
5622 114658						
5622 14 18957 88512 LD DEFFLENM				LD	DE, MAP	; BASE
Section   Sect	562A 110B57	00512		LD		;BASE+INDEX*13
5612 2885 98515 JR Z,MOV1 ;EXIT ON @ TERMINAL 5631 77 98516 LD (HL),A 5632 23 98517 INC HL 5632 23 98517 INC HL 5633 13 88518 INC DE 5634 18P7 88519 JR MOV 5636 EL 88528 MOV1 POP HL ;RESTORE POINTER 5637 23 98521 INC HL 5638 C9 98522 RET 88525; VIDEO DISPLAY UNTIL A TERMINAL CHARACTER OF @ IS 88526; VIDEO DISPLAY UNTIL A TERMINAL CHARACTER OF @ IS 88526; VIDEO DISPLAY UNTIL A TERMINAL CHARACTER OF @ IS 88527 OR A 88528 OUTSTR LD A, (BL) ;GET NEXT CHARACTER 5638 C8 98538 RET Z ;RETURN ON END OF STRING 5630 C8 98538 RET Z ;RETURN ON END OF STRING 5631 C8 98539 GF31 CALL DISPL ;DISPLAY IT 5648 18F7 88533 JR OUTSTR 88534 G8534 OUTSTR HL 88535 ; SUBROUTINE (FLSPEC) BUILDS FILESPEC IN THE FORM OF 88536; "FILESPEC/EXT" FROM THE INPORNATION IN THE FFDE IN THE 88538; THE RESULT IS RETURNED IN THE LOCATIONS STARTING AT 88538; THE RESULT IS RETURNED IN THE LOCATIONS STARTING AT 88538; THE RESULT IS RETURNED IN THE LOCATIONS STARTING AT 88539; (FILEMN> AND TERMINATING WITH A Ø BYTE 5642 ES 98541 FLSPEC PUSH HL 5646 69 98542 LD BC,5 5647 110857 88544 LD DE,FILEMN 5647 110857 88546 FLS9 LD A,(BL); MOVE ONE CHARACTER 5648 18F6 88 88545 LD B,8 ;MAX LENGTH OF NAME 5647 FE20 88548 INC HL 5648 FE20 88549 CP ' ' 5655 13 98551 INC DE 5656 AP 98552 LD NZ 2,FIS1 5656 AP 98553 FLS1 XOR A 5657 12 98554 LD CDE,5+8 ;LOOP FOR WHOLE NAME 5658 E1 98555 LD NZ 2,FIS1 5659 918089 98555 LD A,(BL); TEST FOR EARLY END 5650 72 98558 LD A,(BL); TEST FOR EXTENSION 5650 72 98558 LD A,(BL); TEST FOR EXTENSION 5650 75 98559 POP HL 5651 75 FOR FOR TOULL 5666 C8 98569 CP '' 5666 C8 98569 CP '' 57 FEST FOR FOR TOULL 57 FEST FOR TOULL 57 FEST FOR FOUNT NULL 57 FEST FOR FEST FOR FEST FOR FOUNT NULL 57 FEST FOR			MOV			; MOVE CHARACTER
5632 23					z,MOV1	;EXIT ON 0 TERMINAL
5634 18F7	5632 23	80517		INC		
5636 E1						
Second   S			MOV1	POP	HL	RESTORE POINTER
## ## ## ## ## ## ## ## ## ## ## ## ##					HL	
## 89525 ; VIDEO DISPLAY UNTIL A TERMINAL CHARACTER OF 8 IS ## 89526 ; DETECTED IN THE INPUT STREAM ## 89527  5639 7E			; SUBRO	UTINE <0	UTSTR> COPIES TH	E INPUT STRING TO THE
\$6527 \$639 7E		80525	; VIDEO	DISPLAY	UNTIL A TERMINA	L CHARACTER OF 0 IS
Second   S	5/30 78	<b>00527</b>				
563C CD3388			OUTSTR	OR		GET NEXT CHARACTER
S63F 23					Z	
## ## ## ## ## ## ## ## ## ## ## ## ##	563F 23	00532		INC	HL	INTREME II
### ### ### ### ### ### ### ### ### ##	3048 18F/			JR	OUTSTR	
## ## ## ## ## ## ## ## ## ## ## ## ##		00535 00536	; SUBRO	UTINE (F.	LSPEC> BUILDS FI	LESPEC IN THE FORM OF
08539; <filenm> AND TERMINATING WITH A 8 BYTE 08548 08541 FLSPEC PUSH HL ;SAVE FPDE POINTER 5643 08508 08542 LD BC,5 ;OFFSET FOR NAME 5646 09 08543 ADD HL,BC 5647 110857 08544 LD DE,FILENM 5648 0868 08545 LD B,8 ;MAX LENGTH OF NAME 5640 12 08547 LD (DE),A 5640 12 08547 LD (DE),A 5640 12 08548 INC HL 5640 12 08554 INC HL 5651 2803 08550 JR Z,PLS1 5651 2803 08550 JR Z,PLS1 5653 13 08551 INC DE 5656 AP 08553 FLS1 XOR A 5657 12 08554 LD (DE),A 5658 E1 08555 POP HL 5659 010000 08557 ADD HL,BC 5650 7E 08558 LD A,(HL) ;TEST FOR EXTENSION 5650 7E 08559 CP '' ;TEST FOR EXTENSION 5650 C8 08560 RET Z</filenm>		00537	; DIREC	TORY POI	NTED TO BY THE (	HL)
09548 5642 E5		00538 00539	; THE R	ESULT IS NM> AND	RETURNED IN THE TERMINATING WITH	LOCATIONS STARTING AT
5643 018508 08542 LD BC,5 ;OFFSET FOR NAME 5646 09 08543 ADD HL,BC 5647 110857 08544 LD DE,FILENM 5648 0698 08545 LD B,8 ;MAX LENGTH OF NAME 564C 7E 08546 FLS0 LD A,(HL) ;MOVE ONE CHARACTER 564D 12 08547 LD (DE),A 564E 23 08548 INC HL 564F FE20 08559 JR Z,FLS1 5651 2803 08550 JR Z,FLS1 5653 13 08551 INC DE 5656 AF 08552 DJNZ FLS0 ;LOOP FOR WHOLE NAME 5656 AF 08553 FLS1 XOR A 5657 12 08554 LD (DE),A 5658 E1 08555 POP HL 5659 018D00 08556 LD BC,5+8 ;OFFSET FOR EXTENSION 565C 09 08557 ADD HL,BC 565D 7E 08559 CP '' ;IFSO-RETURN 5656 C8 08560 RET Z	5642 E5	00540				
5647 119857 89544 LD DE,FILENM 564A 8698 89545 LD B,8 ;MAX LENGTH OF NAME 564C 7E 98546 FLS9 LD A,(HL) ;MOVE ONE CHARACTER 564D 12 99547 LD (DE),A 564E 23 88548 INC HL 564F FE20 985549 CP ' ' ;TEST FOR EARLY END 5651 2883 98559 JR 2,FLS1 5653 13 88551 INC DE 5654 18F6 98552 DJNZ FLS0 ;LOOP FOR WHOLE NAME 5656 AF 88553 FLS1 XOR A 5657 12 98554 LD (DE),A ;TERMINATE NAME 5658 E1 98555 POP HL 5659 819088 98556 LD BC,5+8 ;OPFSET FOR EXTENSION 565C 89 88557 ADD HL,BC 565D 7E 88558 LD A,(HL) ;TEST FOR NOT NULL 565E FE28 88560 RET Z	5643 010500	00542		LD	BC,5	
564C 7E	5647 110B57	00544				
564D 12			FLSØ			
564F FE20 80549 CP ' ,TEST FOR EARLY END 5651 2803 80550 JR Z,FLS1 5653 13 80551 INC DE 5654 18F6 80552 DJNZ FLS0 ;LOOP FOR WHOLE NAME 5656 AF 80553 FLS1 XOR A 5657 12 80554 LD (DE),A ;TERMINATE NAME 5658 E1 80555 POP HL 5659 818D80 80556 LD BC,5+8 ;OPFSET FOR EXTENSION 565C 89 80557 ADD HL,BC 565D 7E 80558 LD A,(HL) ;TEST FOR NOT NULL 565E FE20 80559 CP ' ;IF SO-RETURN	564D 12	00547		LD	(DE),A	,
5653 13	564F FE20	88549		CP	1 1	TEST FOR EARLY END
5654 10F6						
5657 12 90554 LD (DE), A ;TERMINATE NAME 5658 E1 90555 POP HL 5659 910000 90556 LD BC,5+8 ;OFFSET FOR EXTENSION 565C 09 90557 ADD HL,BC 565D 7E 90558 LD A,(HL) ;TEST FOR NOT NULL 565E FE20 90559 CP ' ; ;IF SO-RETURN 5660 CB 90560 RET Z	5654 10F6	00552	B1 C3	DJN2	FLS0	; LOOP FOR WHOLE NAME
5658 E1	5657 12		rLS1			;TERMINATE NAME
565C 09	5658 El			POP	HL	•
565E FE28 00559 CP ' ;IF SO-RETURN 5660 CB 00560 RET Z	565C Ø9	00557		ADD	HL,BC	•
5660 C8 00560 RET Z						
Listing continues					Z	
						Listing continues

```
Listing continued
                                          DE.HL
5662 362F
5664 23
                ØØ562
ØØ563
                                           (HL),'/'
                                                             ;SET EXTENSION IN FILENM
                                 INC
                                          HT.
5665 77
                00564
                                           (HL),A
                                                             :MOVE 1ST CHAR
5666 EB
                                          DE,HL
                00565
                                 ΕX
5667 13
5668 23
                                 INC
                                          DE
                00567
5669 7E
                00568
                                 T.D
                                          A,(HL)
                                                             :TEST FOR TERM
566A FE20
566C 280A
                00569
                99579
                                 JR
                                          Z,FLEXIT
                                           (DE),A
566F 13
                00572
                                 INC
5670 23
                00573
                                 TNC
                                          HT.
                                          A,(HL)
5671 7E
                                 LD
                                                              :THIRD CHARACTER
5672 FE20
                00575
                                 CP
                                                              TEST FOR TERM
5674 2802
5676 12
5677 13
                00576
                                          Z.FLEXIT
                                 JR
                00577
                                           (DE),A
                                 TNC
                00578
                                          DE
                00579 FLEXIT
                                 XOR
5679 12
567A C9
                00580
                                 LD
                                           (DE),A
                                                             FORCE TERMINAL
                                 RET
                00581
                00583
                00584 ; DATA DEFINITION AREA
567B 2A
568F ØDØØ
                00586 TITLE
00587
                                 DEFM
                                           '* DISK GRANULE MAP *'
                                 DEFW
                                           CR
5691 ØD
                                          CR
'**** ILLEGAL DRIVE NUMBER!'
                00588 ERR1
                                 DEFB
5692 2A
                00589
                                 DEFM
56AC ØDØØ
                00590
                                 DEFW
                                           CR
56AE ØD
56AF 2A
                00591 ERR2
00592
                                 DEFB
                                          CR
                                 DEFM
                00593 DRNR
56BA 30
                                           'Ø IS NOT READY!'
                                 DEFM
                00594
                                 DEFW
                                           CR
                00595 DKMSG
00596 DRVNR
00597 DKNAME
                                           DRIVE:
                                 DEFM
56C9 0D00
                                 DEFM
56CB 44
56D1 30
                                 DEFM
                                           'DISKNAME
                00598 DATE
00599 GRANS
                                 DEFM
                                           '0 TRKS LOCKED OUT:
                                           'MM/DD/YY
                                                      GRANS FREE: '
56D5 44
                                 DEFM
56DF 4D
56F4 30
                 00600 TLO
                                 DEFM
                88681
                                 DEFB
5708 30
570A 00
570B 46
                 00602 FILENM
                                           'FILESPEC/EXT'
                                 DEFM
                00603
00604 SELBIT
00605 DIRERR
                                 DEFB
                                 DEFR
5717
                                 DEFB
5718 00
                00606
00607
                                 DEFM
                                           '**** DIRECTORY READ ERROR!
5719 ØD
                                 DEFW
                                           CR
571A 2A
                 00608 PAGES
                                 DEFW
5734 0D00
                00609 PRMPT0
                                           ODODH
'PLACE THE DISKETTE TO MAP IN DRIVE 0'
                                 DEFW
5736 0000
                                 DEFM
5738 ØDØD
573A 50
                 00611
                 00612
                                 DEFM
                                           'PRESS <ENTER> TO CONTINUE'
575E ØD
                                 DEFW
                                           'PRESS ANY KEY FOR NEXT 10 TRACK DISPLAY'
575F 50
                 00614 PRMPT1
                                 DEFM
5778 ØDØØ
                 00615
                                 DEFR
577A 5Ø
                 00616 PRMPT2
                                 DEFM
                                           PRESS @ TO DISPLAY AGAIN,
57A1 00
                 00617
                                 DEFM
                                           ANY OTHER KEY TO EXIT
                 00618
                                 DEFB
57BB 41
                 00619 TRK
57DØ ØØ
                       TRKNR
                 00620
                                 DEFW
57pl 0000
                 00621 LINE3
                                           191
                                 DEFB
57D3 0000
                 00622
                                 DEFM
                                                  1ST GRANULE
57D5 BF
                 00623
                                 DEFB
                                           191
57D6
     20
                 00624
                                 DEFM
                                                   2ND GRANULE
                                          191
'TRACK NUMBER: 0
57EC BF
                 00625
                                 DEFW
57ED 20
                 00626 LINEN
                                 DEFM
5803 BF00
                                           191
                                 DEFB
5805 54
                 00628
                                 DEFM
                                           191
5816 BF
                 00629
                                 DEFB
5817 20
                 00630
582D BF
                                           191
                 00631
                                 DEFW
582E 20
5844 BF00
                 00633
                 00634
                       ; SYSTEM LABEL DEFINITIONS
                 00635
                00636
00637 CMDBUF
                                                              :DOS COMMAND BUFFER
                                           4318H
                 00638 STATUS
                                           37ECH
                                                              FDC STATUS REGISTER
                                                              ;FDC COMMAND REGISTER
                 00639 CMDREG
                                           37ECH
37EC
                 00640 SECTOR
                                 EOU
                                           37EEH
                                                              :FDC SECTOR REGISTER
37EC
                 00641 DATARG
                                 EQU
                                           37EFH
                                                              ;FDC DATA REGISTER
37EE
                 00642 SELECT
                                 EOU
                                           37E1H
                                                              ;FDC SELECT LINES
;DIRECTORY BUFFER
37EF
                 00643 BUFFER
                                 EQU
                                           6000H
                00644 GAT
00645 FDES
37E1
                                 EQU
                                           BUFFER
6000
                                           BUFFER+0200H
                                 EOU
                                                              ;START OF FDE'S IN BUFFER
6000
                 00646 VIDEO
                                 EQU
                                           3CØØH
6200
                 00647 DIRTRK
00648 NRTRKS
                                 EOU
                                           17
                                                              ;DIRECTORY ON TRK 17
;NUMBER OF TRACKS
                                 EOU
                                           40
0011
                 00649 DOS
                                           402DH
0028
                 00650 CURSOR
                                           4020H
01C9H
                                 EOU
402D
                 00651 CLS
                                  EQU
                                                              :BASIC CLEAR SCREEN
4828
                 00652 HLACC
                                           ØA9AH
                                                              ; ROM ROUTINE HL-->ACCUM
Ø1C9
                 00653 CVTASC
                                 EOU
                                           ØFBDH
                                                              ; ROM CVT ACCUM TO STRING
ØA9A
                 00654 GETKEY
                                           0049H
                                  EOU
                                                              :WAIT FOR KEY
ØFBD
                 00655 DISPL
0049
                 00656 DELAY
                                  EOU
                                           0060H
0033
                        CR
                                  EQU
9969
                 00658
000D
                 00659
5846
                 00660 MAP
                                  EOU
                                                              STARTING ADDRESS FOR MAP
5300
                                           DSKMAP
                 00661
```

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# Scramble space ships instead of eggs.

# Astro-Scramble

Randy Long 4791 Torida Way Yorba Linda, CA 92686

Combining Astro-Blasters and Scramble yields the fast action arcade game, Astro-Scrambler. I'll use an earlier version, a game called Dodge, to

demonstrate the evolution of Astro-Scrambler. To better understand Astro-Scrambler, let's walk through Dodge.

#### Program Sketch

To start, we need a spaceship:

- 20 CLS: RANDOM: P = 31
- 30 PRINT @960,""
- 40 PRINT @P, CHR\$(130) CHR\$(175) CHR\$(135);

```
HS
         - High score
нu
         - Highest set reached
A$(1-26)

    Objects which shoot at you

NS
         Credit
D$
         - Downward Line Feed
U$
         - Upward Line Feed
15
         — INKEYS
          - Lights new high score
          - Ship position
С
          - Used in PEEKing
          - Used in loops
          - Score counter
          - Number of objects in each set
          - Number of sets passed
          - Used in instructions
```

Table 1. List of Variables

- 60 IF PEEK(14400) = 32 THEN P = P - 2: IF P<2 THEN P = 3: GOTO 70 ELSE 70
- 70 IF PEEK(14400) = 64 THEN P = P + 2: IF P>890 THEN P = 890: GOTO 80
- 80 REM used later
- 100 GOTO 30

The ship's location is the variable P (see Table 1). P is increased or decreased (and the ship moved to either side) with the left and right arrow keys. PEEK (14400) is the fastest way to scan the keyboard to check which key is being pressed.

Type this addition into your program:

30 PRINT @ 960 + RND(60), CHR\$(174) CHR\$(191) CHR\$(157)

Since line 30 does not have a semi-colon at the end, the screen moves up one line to print the next asteroid. The program, as it is now, is fast and fun, but not very challenging—

Listing continues

you can fly unchallenged through the asteroids.

PEEKing locations 15360– 16383 makes the computer look one space ahead of your ship. If it finds something in this space it reasons you have crashed into an asteroid. If nothing is in this space you continue flying.

Now add this line:

50 C = PEEK(15360 + P + 65): IF C = 32 THEN 60 ELSE PRINT @ P - 3, "BOOM!!":: GOTO 50

The variable C is assigned the ASCII code number of the space in front of your ship. If nothing is there, C will equal 32. If it does not equal 32, you have run into an asteroid.

You now have version 1: Dodge. To stay alive you must dodge the objects shooting at you.

In Program Listing 1, I added many new objects and a scoring system creating the game Astro-Scrambler. This game is just like a real action arcade. It is not easy to win!

#### **Program Modifications**

For a longer game change line 280 to:

280 N = N + 1 :B = B + 1 :IF B = ### THEN B = 0 :U = U + 1 :IF U = 26 THEN 300

Make ### high (60) for a longer game or low (15) for a shorter game.

Make your own objects shoot

#### The Key Box

Basic Level II Model I 4K RAM

#### Program Listing 1. Astro-Scrambler

# PRIORITY ONE ELECTRONICS

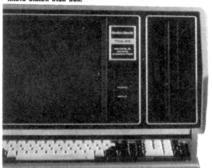
# 3 DRIVE MODEL II MASS STORAGE FROM INTERNATION INC

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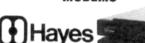
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Change your ship's looks in line 240. Try this:

240 PRINT@ P, CHR\$(133) CHR\$(191) CHR\$(138);

For a more colorful game change line 230 to:

230 PRINT@ 959 + RND(60), AS(RND(26))

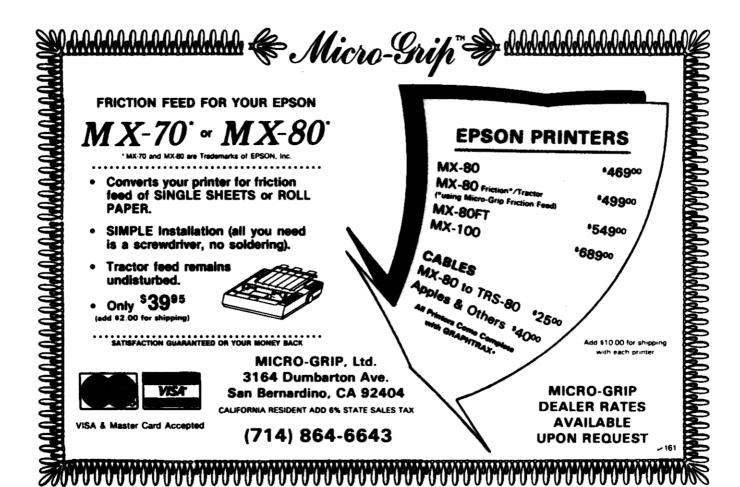
To make your ship move faster from side to side change line 260 and 270:

280 IF PEEK(14400) = 32 THEN P=P-4: IF P<3 THEN P=3 270 IF PEEK(14400) = 64 THEN P=P+4: IF P>890 THEN P=890

Enjoy, good luck and keep trying!■

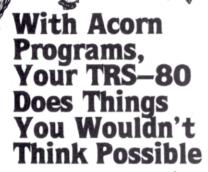
Randy Long, an 18 year-old Senior at Troy High School in Fullerton, CA, plans to enroll at California State Polytechnic University to study Computer Sciences. 158 A\$(11)=U\$+CER\$(184)+CER\$(189)+CHR\$(144)+D\$+STRING\$(3,0)+CER\$(175)+CHR\$(175)+CHR\$(113); a\$(12) = U\$+U\$+U\$+CHR\$(144)+D\$+STRING\$(3,0)+CER\$(149)+D\$+CER\$(8)+CER\$(149)+D\$+CER\$(8)+CER\$(139)+D\$+CER\$(8)+CER\$(139)+D\$+CER\$(139)+CHR\$(175)+CHR\$(

448 X\$ = STRING\$(31,129+RMD(62)) :PRINT\$ 128,X\$;:PRINT\$ 328,X\$;
458 IF L = 1 PRINT\$ 328,\*\*\*\*\* NEW HIGH SCORE \*\*\*\*\*,
468 L\$ = INKEY\$ :IF L\$ = "" THEN 448 ELSE IF L\$ = CHR\$(13) THEN RETURN ELSE
IF L\$ = "P" THEN RETURN ELSE 448



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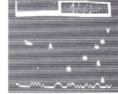
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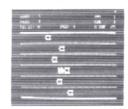




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# Checking the odds.

# Craps Unrolled

Bruce Chaffee 6571 Edgemont Huntington Beach, CA 92647

A chance remark by a Las Vegas devotee about losing his shirt at craps led to an interesting experiment which demonstrates the power and versatility of the TRS-80.

The premise is simple: To find the probability of winning at craps, simulate the game on the computer and play a huge number of games. The probability of winning should then be close to the ratio wins over wins plus losses. If this ratio is greater than .5 you may expect to win more often than lose, and craps is a good bet. Is it really that easy?

Here are two such programs, using the rules shown in Fig. 1. Program Listing 1 plays the game 10,000 times and Program Listing 2 allows you to choose the number of games the computer will play. If you load and run the program in Listing 2 (set the number of games at about 10,000), you will probably observe that the first few digits soon settle down to .49XXXX. Sounds great! All you need do is let the computer run until more

and more digits stay fixed.

### **Problems**

Assuming that the roll of real dice is random, we are still left with two problems with our simulation. First, how certain are we of an answer close to the real answer? Second, how random are the "pseudo-random" numbers the computer generates?

To answer the first of these questions, play 10,000 games 10 times, and use the standard deviation of the 10 individual results to estimate the accuracy. We will approach the second question more indirectly. If we calculate the actual result from principles of probability, we can then compare the theoretical result to the experimental result. The agreement, or lack of it, will be a test of the random number generator.

# **Random Numbers**

I have provided an outline of the calculation of the theoretical answer. You may want to skip the calculation and simply note the result at the end of this paragraph.

P(win) = P(win first roll) + P(win on subsequent rolls) P(win first roll) = P(7 first roll) + P(11 first roll) = 6/36 + 2/36 Calculating P(win first roll) is easy. Calculating P(win on subsequent rolls) is a bit more complicated because winning can occur if you roll a 4, 5, 6, 8, 9 or 10 on the first roll and then match your point before you roll a 7. You can calculate these probabilities separately and then add them. For example:

P(win with point = 4) = P(4 on first roll) [P(4 on second roll) + P(no win on second roll) \* P(4 on third roll) + . . . ]

P(win with point = 4) =  $3/36(3/36 + 3/36(1 - 9/36) + 3/36(1 - 9/36)^2 + \dots)$ 

Notice the right side is a geometric series which you can add. It equals 1/3. The other cases are similar, yielding a theoretical result of .492929, a repeating decimal.

Program Listing 3 is a program to analyze the data.

I put the program in Listing 1 in a loop which executed the Random command after each 10,000 games, and found the ten results shown in Table 1. The results can be summarized by say-

The Key Box Basic Level II Model I or III 16K RAM Printer required

Trial	Number of Games	Probability
	or Games	of Winning
1	10,000	.4969
2	10,000	.4928
3	10,000	.4923
4	10,000	.4972
5	10,000	.5003
6	10,000	.4958
7	10,000	.4882
8	10,000	.4956
9 .	10,000	.4802
10	10,000	.4911
	Table 1	

ing the overall average is .49304 and the standard deviation is .00569351. That is, with:

50 percent certainty .492659≤p≤.493422 68.3 percent certainty .492471<p<.493609 95.6 percent certainty .491901≤p≤.494179 99.7 percent certainty .491332<p<.494748 From before, the true answer is .492929, so the experimental answer is off by [.49304-.4929<del>29</del>] ≅ .000111, which is much less than one standard deviation.

The method seems to work. We did something more than approximate an answer we already knew. The method would not have worked if the pseudo-ran-

```
First Roll
                                   Subsequent Rolls
 Win
                                    Match first roll.
                 7.11
                                      or "point"
              2 3 or 12
Lose
                   Figure 1
```

```
6 FOR NU=1T018
7 I=8:S=8:J=8:W=8:L=8
18 CLS:PRINT932,CHR$(32);:PRINT"18,888 GAMES":N=18888
                         ***** SET UP HEADINGS *****
16 39 PRINTe128, "FIRST ROLL"
48 PRINTe256, "SUBSEQUENT ROLLS"
59 PRINTe512, "WINS"
68 PRINTe527, "LOSSES"
79 PRINTe542, "TOTAL"
88 PRINTe784, "'PROBABILITY'"
84 '
                          **** MAIN LOOP ****
98 FOR I=1 TO N
188 S1=RND(6)+RND(6)
128 IF S1= 2 OR S1=3 OR S1=12 THEN L=L+1; GOTO 228 'TRY OTHER RUL
128 IF S1= 2 OR S1=3 OR S1=12 THEN L=L+1:

ES HERE

138 IF S1=7 OR S1=11 THEN w=w+1: GOTO 228

148 J=8

159 S2=RND(6)+RND(6)

179 J=J+1
188 IF S2=S1 THEN W=W+1: GOTO 228
198 IF S2=7 THEN L=L+1: GOTO 228
288 GOTO 158
286
                           ***** PRINT RESULTS *****
228 PRINT@686,(W+L)
238 PRINT@778,CHR$(38);W/(W+L)
246 NEXTI
388 LPRINT"RANDOM EVERY 18,888 W =";W;"L =";L;" P = ";W/(W+L)
 316 RANDOM
                                          Program Listing 1
```

```
5 DEFINT S,J: W=0:L=0
10 CLS:PRINT032,CHR$(32);:INPUT*NUMBER OF GAMES*;N
14 '
                          ***** SET UP HEADINGS *****
16 '
39 PRINTél28, "FIRST ROLL"
49 PRINTé256, "SUBSEQUENT ROLLS"
50 PRINTé512, "WINS"
60 PRINTé527, "LOSSES"
78 PRINTé542, "TOTAL"
80 PRINTé784, "'PROBABILITY'"
                          ***** MAIN LOOP *****
98 FOR I=1 TO N
95 IF INT(N/1868)*1868=N THEN RANDOM
186 S1=RND(6)+RND(6)
118 PRINTE(148,S)
128 IF S1= 2 OR S1=3 OR S1=12 THEN L=L+1: GOTO 218 'TRY OTHER RUL
ES HERE
136 IP S1=7 OR S1=11 THEN W=W+1: GOTO 216
140 J=0
150 S2=RND(6)+RND(6)
160 PRINT0320+J*3,S2
176 J=J+1
186 IF S2=S1 THEN W=W+1: GOTO 216
196 IF S2=7 THEN L=L+1: GOTO 216
200 GOTO 150
                            ***** PRINT RESULTS *****
207
210 PRINTe320, CHR$ (30): PRINTe384, CHR$ (30)
220 PRINTe576, W. PRINTe591, L: PRINTe606, (W+L)
230 PRINTe770, CHR$ (30); W/ (W+L)
240 NBXII
                                            Program Listing 2
```

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dom numbers were not close to random. The results suggest that the pseudo-random numbers were suitable for this technique and next time you can use them with more confidence.

# **Final Thoughts**

It is very difficult to control the seed number of the random number generator. This makes it difficult to duplicate an experiment.

Are the results presented here too good? The overall average is surprisingly close to the true value. In other experiments the overall average was not so close. I selected the data presented here because they are the first 10 results produced after I turn on the machine, and in this sense they can be duplicated.

If you ran the program with 10,000 games, then you might think that 20,000 games would give an answer that is twice as accurate. Such is not the case. In general, the expected error varies as 1/√n. In other words, to get one more significant digit (decrease the error by a factor of 10) you must increase the num-

ber of trials by a factor of 100 (to 1,000,000). Often, other methods of increasing accuracy are more productive.

If you change the rules of the game, what happens to the probability of winning? The first time I played craps we used the rule that you did not lose if you got a three on the first roll. That is, three was just like any other point. Does this change things much? Change line 120 by deleting OR S1 = 3, and see what the simulation tells you. (The theoretical value is  $.506\overline{81}$ .)

The Monte Carlo technique, of which this is a crude example, can be used on very difficult problems to give an approximate answer. The method does, however, lead fairly quickly to some unavoidable mathematics. I have tried to minimize the math used here in order not to obscure the central ideas. You can refer to any standard text on statistics for a more detailed explanation.

Mr. Chaffee received a master's degree in mathematics. He works as a consultant in microcomputer applications.

```
***** PROGRAM TO ANALYZE DATA *****
18 '
18 " PROGRAM TO ANAL'

15 CLS

28 INPUT" HOW MANY NUMBERS";N

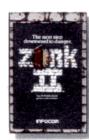
38 DIM N(N)

48 FOR I=1 TO N

58 INPUT"ENTER NUMBER"; N(I)
68 NEXT I
 80 SUM = 0
90 FOR I=1 TO N
100 SUM = SUM + N(I)
 110 NEXT I
120 ' **** AVERAGE *****
138 AVG = SUM/N
148 ' **** SIGMA *****
139 AVG = SUM/N
146 '**** SIGMA *****
156 DEV = 8
169 FOR I=1 TO N
178 DEV = DEV +(AVG-N(I))[2
188 NEXT I
198 SIG = SQR(DEV/(N-1))
289 '**** RESULTS ****
218 FOR I = 1 TO N
226 LPRINT N(I);
234 MEYET
234 MEYET
 230 NEXT I
240 LPRINT
245 LPRINT
  250 LPRINT " AVG = "; AVG
260 LPRINT "STANDARD DEVIATION =";SIG
  275 LPRINT"58% CERTAINTY
                                                                                                                          ";SUM-.67*SIG;" <= SUM <= ";SUM+.67*SI
                                                                                                                                  ";SUM-SIG;" <= SUM <= ";SUM+SIG
";SUM-2*SIG;" <= SUM <= ";SUM+2*SIG
";SUM-3*SIG;" <= SUM <= ";SUM+3*SIG
  286 LPRINT*68.3% CERTAINTY
285 LPRINT*95.6% CERTAINTY
296 LPRINT*99.7% CERTAINTY
  300 LPRINT
  300 LPRINT
320 LPRINT ";(SUM-.67*SIG)/N;" <= 'P' <= ";(SUM+
  .67*SIG)/N
330 LPRINT"68.3% CERTAINTY
                                                                                                                                    "; (SUM-SIG) /N; " <= 'P' <= "; (SUM+SIG)
   335 LPRINT"95.6% CERTAINTY
                                                                                                                                    ";(SUM-2*SIG)/N;" <= 'P' <= ";(SUM+2*
    SIG)/N
    348 LPRINT*99.7% CERTAINTY
                                                                                                                                    ";(SUM-3*SIG)/N;" <= 'P' <= ";(SUM+3*
  348 LPRINT"99.7% CERTAINTY ";(SUM-3"SIG)/N;" <= "P' <= ";(SUM+3"SIG)/N;" >= ";(SUM+3"SIG)/N;" >= "P' <= ";(SUM+3"SIG)/N;" >= "SUM+3"SIG)/N;" >= "SUM+3"SIG)/N;" >= "SUM+3"SIG)/N;" >= "SUM+3"SIG)/N;" >= "P' <= ";(SUM+3"SIG)/N;" >= "P' <= ";(SUM+3"SIG)/N;" >= "P' <= ";(SUM+3"SIG)/N;" >= "P' <= ";(SUM+3"SIG)/N;" >= "SUM+3"SIG)/N;" >= "P' <= ";(SUM+3"SIG)/N;" >= "P' <= ";(SUM+3"SIG)/N;" >= "P' <= ";(SUM+3"SIG)/N;" >= "SUM+3"SIG)/N;" >= "SUM+3"
```

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# Find it fast in your Basic programs.

# Search Them Strings

John R. Gunter Charles Gunter 756 Twin Branch Drive Birmingham, AL 35226

If necessity is the mother of invention, then aggravation must be a close relative. That's why I wrote this string search utility. Written in machine language for a 16K Level II TRS-80, it searches even the largest of Basic programs in 10 seconds or less.

Search is a small program that takes about 365 bytes of memory. I kept it short by using ROM routines extensively.

It's simple to use: Single keys command everything. It's also easy to access: You need only five keystrokes to get from Basic to the utility; only one key to return to Basic.

# **Inspiring Aggravation**

The aggravation that inspired this program started with a Basic simulation game that we bought. Never willing to let well enough alone, we immediately set out to modify the new program. Enter the aggravation. This was one of those packed Basic programs. You know the kind—when you list it, the screen turns almost solid white as a blizzard of symbols fly past.

After some frustrating at-

tempts to find things in the program, we called a time-out to write the search utility.

The simulation program filled the top half of the screen with labels and numbers that were the results of complex equations. To find out which variables drove the numbers on the screen, we input the label into the search utility. A few seconds later, the print message was on the screen, complete with variable name.

Next, by searching for the variable name, we found the equation that calculated the variable.

Now, we wanted to see how the factors in the equation behaved, so we wrote some print statements for the bottom part of the screen. Just as we were starting to learn something, one of the simulation program's "disaster messages" appeared on the screen—where else, but right on top of our newly inserted print statements.

Back to the search utility, and in a few seconds the Print @ statement appeared on the screen. We moved the Print @ lower on the screen and went back to run the Basic program.

Zap! Another disaster message. A second search showed that this disaster message was another Print @ for the same location. Being clever, we detected a pattern emerging. Time for another search, this time for Print @ and the appropriate screen locations. This search located all the rest of the disaster messages, which we then moved.

We were all set! Then, all of our messages began flashing like a neon sign. We returned to the search utility once again to look for a clear to the end of the screen message (PRINT CHR\$(31)). We moved all these.

Next, we wanted to write some equations of our own, but which variables were free (that is, unused in the program)? We picked a variable name we liked, and entered it as a search argument in the utility program. If the "string not found" message came back from the utility, the variable was free for us to use.

# **Using the Utility**

To use the utility, set the memory size to 32425. Then type SYSTEM and respond to the \*? prompt with the program name SEARCH.

When the program has loaded, type / and press Enter. This loads the start address of the utility into 418FH. This is the DOS jump address for the command NAME.

Now, load the Basic program

you want to search.

To access the utility, type NAME and press Enter. The screen clears and the message "output to printer (Y/N)?" appears. When you make your selection, the message "enter string:" appears. Type the string you want to search for and press Enter.

If the utility finds the string, it lists the Basic line containing it on the screen or printer, whichever you selected.

To continue searching for subsequent occurrences, press Enter. To start a new search, press Break. To return to Basic, press shift up-arrow.

When the search reaches the end of the Basic program, the message "string not found" will appear on the screen (even if you selected the printer as the output device). At this point either Break or shift up-arrow is valid.

# **Details of the Utility**

Search, shown in Program Listing 1 is completely relocatable. Just redefine the first line. Note that the buffer variable extends from the end of the program, so don't jam the program against something else. I allowed 28 bytes.

Lines 140 to 170 put the start address in the NAME jump address and return you to Basic. Lines 220 to 290 ask for your choice of output device. If you don't want to use a printer, delete the lines that have an asterisk in the comment column.

If you select the printer, a one is stored in the output device control byte (lines 300-310). If not, the screen is the output device, since the byte is initialized to zero (lines 200-210).

Next, the program outputs the prompt to enter the string (lines 360–410). The character is accepted (line 450), checked for enter (line 460), stored in the buffer (lines 530–540) and displayed on the screen (line 550).

The utility stores the pointer to the first line in PRSADD (lines 650-660). Similarly, it recovers and stores the pointer to the next line in NXTADD (lines 670-710).

The contents of the Basic line are read into the input buffer using a routine from the ROM that also expands the Basic tokens (lines 770–820). (For an explanation of the structure for Basic line storage in memory, see William Barden's column "The Assembly Line" in the January, 1981 issue of 80 Microcomputing.)

Next, Search compares the first character of the string you want to each character in the Basic program line (lines 840-960). If the first character matches (line 970), it compares subsequent characters (lines 1020-1050).

If all characters match, it outputs the line number (lines 1110-1160) and its contents (lines 1170-1220). Following this, the program waits for input (line 1230), accepting either Enter (lines 1240-1250), Break (lines 1260-1270) or Shift up-arrow (lines 1280-1290).

If it finds no match in a line, the NXTADD becomes the PRSADD. It checks to determine if this is the last line (lines 720-760). If so, it outputs the "string not found message" (lines 1310-1360); only Break or Shift up-arrow (lines 1370-1410) are valid now.

# A Basic Approach

If you haven't an assembler, don't despair. I have provided not one, but two Basic programs

# Program Listing 1. Search

```
00100 ;
                           SEARCH UTILITY FOR BASIC PROGRAMS
                00110
                           FOR 16K LEVEL II TRS-80
                       :
                00120
                                                             DETERMINES PROGRAM LOCATION
                00130 START
                                 EOU
                                          7EAØH
7EA0
                                                             SET MEM SIZE TO THIS VALUE
                                          START-10
7E96
                00140
                                ORG
     21A07E
                                 I.D
                                          HL.START
                                                             PUTS START ADDRESS IN THE
                00150
7E96
     228F41
                00160
                                 LD
                                          (418FH),HL
                                                               "NAME" JUMP ADDRESS
7E99
     C36600
                00170
                                 JP
                                           66H
                                                             RETURN TO BASIC
7EA0
                88188
                                 ORG
                                          START
7EA0 CDC901
                00190 START
                                 CALL
                                          1C9H
                                                             CLEAR THE SCREEN
                                                             *SET OUTPUT DEVICE TO BE
7EA3
                00200
                                 XOR
                                          (409CH),A
7EA4 329C40
                00210
                                 LD
                                                             *THE SCREEN
7EA7 21A17F
                                          HL, MSSG1
                                                              *POINT TO MESSAGE # 1
                00220
                                 LD
                                                             ; *OUTPUT IT TO THE SCREEN
; *GET A CHARACTER FROM KEYBOARD
7EAA CDA728
                00230
                                 CALL
                                          28A7H
7EAD CD4900
                00240
                                 CALL
                                          49H
                                                             * SAVE THE CHARACTER AND
                                 PUSH
7EBØ F5
                00250
                                          AF
                                                             ;*DISPLAY IT ON THE SCREEN
;*RESTORE THE CHARACTER AND
7EB1 CD3300
                                 CALL
                                          33H
                00260
7EB4 F1
                00270
                                 POP
                                                             ; *RESTORE THE CHARACTER AND
; *SEE IF IT'S A "Y"
; *IF NOT SKIP THE NEXT 2 LINES
7EB5 FE59
                00280
                                 CP
                                           59H
                                          NZ, NOPRNT
7EB7
     2005
                00290
                                 JŔ
                                                              *SET THE OUTPUT DEVICE
7EB9
      3E01
                00300
                                 LD
      329C40
                00310
                                 LD
                                           (409CH),A
                                                             **FLAG TO PRINTER
**OUTPUT CARRIAGE RETURN
7EBB
7EBE
      3EØD
                 00320
                        NOPRNT
                                 LD
                                           A.13
7ECØ CD3300
                00330
                                 CALL
                                          33H
                                                             ; *TO THE SCREEN
:TURN ON THE CURSOR
                00340
00350
                                          A,14
33H
7EC3 3E@E
                                 LD
                                 CALL
                                                              OUTPUT IT
      CD3300
7EC5
7EC8 21BA7F
                                                              POINT TO SECOND MESSAGE
                99369
                                 LD
                                           HL,MSSG2
                                                              , *GET USER'S OUTPUT DEVICE
7ECB 3A9C40
                 00370
                                 LD
                                           A, (409CH)
                                                              *AND SAVE IT
                                 PUSH
7ECE F5
                 00380
                                           AF
                                                              **SET OUTPUT DEVICE TO BE
7ECF AF
                 00390
                                 XOR
                                           (409CH),A
                                                              *THE SCREEN, TEMPORARILY
      329040
7EDØ
                 00400
                                 LD
                                          28A7H
                                                              OUTPUT THE SECOND MESSAGE
      CDA728
                 00410
                                 CALL
7ED3
                                                               *RESTORE THE USER'S CHOICE
7ED6 F1
                 00420
                                 POP
                                           (409CH),A
7ED7
     329C40
                 00430
                                                               *OF OUTPUT DEVICE
                                                              POINT TO BUFFER
7EDA
     21E17F
                 00440
                                 T.D
                                           HL.BUFFER
                                                              GET CHARACTER FROM KEYBOARD
                 00450
                        READ
                                 CALL
                                           49H
7EDD
      CD4900
                                                              ; IS IT THE "ENTER" KEY?
7EEØ
      FEOD
                 00460
                                 CP
                                                              ; IF SO, GO TO FIND
; IS IT THE "BACK ARROW" KEY?
; IF NOT, THEN GO TO CONT
      2811
                 00470
                                 JR
                                           Z,FIND
7EE2
7EE4
     FE08
                 00480
                                 CP
                                 JR
                                           NZ . CONT
7EE6
      2006
                 00490
7EE8
                 00500
                                 DEC
                                           HI.
                                                              DECREMENT THE BUFFER POINTER
      2 R
                                                              BACKUP THE SCREEN CURSOR GO GET ANOTHER CHARACTER
      CD3300
                                           33H
7EE9
                 00510
                                 CALL
7EEC
      18EF
                 00520
                                 JR
                                           READ
                                                              PUT CHARACTER IN BUFFER
7EEE
                 00530
                        CONT
                                 T.D
                                           (HL),A
                                 INC
                                                              INCREMENT THE BUFFER POINTER
                 99549
7EEF
      23
                                           HI.
                                                              ; PUT CHARACTER ON SCREEN
      CD3300
                                 CALL
                                           33H
                 00550
7EFØ
                 00560
                                           READ
                                                              G GET ANOTHER CHARACTER
                 00570
                        ; BEGINING OF SEARCH ROUTINE
                 99289
                 00590
                                                              ; MARK END OF BUFFER WITH ZERO
7EF5 3600
                 00600 FIND
                                 LD
                                           (HL),0
                                                              ; PUT A CARRIAGE RETURN
                                           A,13
7EF7
      3EØD
                                  LD
                                                              OUT TO THE SCREEN
7EF9
      CD3300
                 00620
                                 CALL
                                           33H
                                           A,15
33H
                                                              TURN OFF THE CURSOR OUTPUT IT TO THE SCREEN
7EFC 3EØF
                 00630
                                 L.D
7EFE CD3300
                 00640
                                 CALL
                                                              GET ADDRESS OF FIRST LINE
7F01
      2AA448
                                           HL, (40A4H)
                                                              PUT IT IN PRESENT ADDRESS
      22DB7F
                 00660
                        NWLINE
                                           (PRSADD), HL
                                                              GET THE LOW BYTE OF THE NEXT
7FØ7
                 99679
                                  t.D
                                           A, (HL)
                                                              LINE ADDRESS AND STORE IT
                                  LD
 7F@8
      32DD7F
                 99689
                                           (NXTADD) .A
7FØB
                 00690
                                  INC
                                           HL
                                           A, (HL)
7FØC
                 00700
                                                              GET THE HIGH BYTE OF THE NEXT
7F0D 32DE7F
                                           (NXTADD+1),A
                                                              ; LINE ADDRESS AND STORE IT
                 00710
                                  LD
                                                              GET THE PRESENT LINE ADDRESS; CHECK TO SEE IF THE VALUE
7F10
      2ADB7F
                 00720
                                  T.D
                                           HL. (PRSADD)
                                  LD
                 00730
7F13
                                           A,H
7F14 B5
                 00740
                                  OR
                                                              ; IS ZERO WHICH INDICATES THE
                                                              ; END OF THE BASIC PROGRAM
      286A
                 00760
                                  JR
                                           Z.THRU
                                                              ; IF SO, GO TO THRU ; MOVE OVER
                 00770
                                  INC
                                           HL
7F19
      23
      23
                 00780
                                  INC
                                           HL
                                                              TO THE FIRST
7FlA
                                                              CHARACTER OF THE
7F1B
                 00790
                                  INC
                 00800
                                  INC
                                                              BASIC PROGRAM LINE
                                                              PUT LINE IN INPUT BUFFER
POINT TO ADDRESS OF INPUT BUFFE
                                           2B7EH
7F1D CD7E2B
                 99819
                                  CALL
                                           HL,41E8H
7F20 21E841
                 00820
                                  LD
                                  LD
                                           DE, BUFFER
                                                              POINT TO SEARCH PROGRAM BUFFER
 7F23 11E17F
                 00830
                        BUFF1
                 00840
                                                              ; INITIALIZE THE MATCH FLAG
                                  XOR
                                                              :WITH A ZERO--NO MATCH
 7F27 32DF7F
                 00850
                                  LD
                                           (MTCHFL),A
                                                              GET NEXT CHARACTER FROM THE
7F2A 1A
7F2B 47
                        BUFFNX
                 00860
                                  LD
                                           A, (DE)
                                  LD
                                           B, A
                                                              ; SEARCH PROGRAM'S BUFFER
                 00870
 7F2C AF
                 00880
                                  XOR
                                                              AND CHECK TO SEE IF IT IS
                                                              THE END OF BUFFER MARKER
 7F2D B8
                 00890
                                  CP
                                                              ; IF SO, GO TO THE MATCH ROUTINE
 7F2E 281F
                 88988
                                  JR.
                                           Z, MATCH
                                                              GET NEXT CHAR FROM INPUT BUFFER IS THIS THE END OF THIS LINE?
 7F30 7E
                 00910
                        NXCHAR
                                  LD
                                           A, (HL)
 7F31 FE00
                 00920
                                  CP
                                                              ; IF SO, GO TO GET NEXT LINE
 7F33 2815
                 00930
                                  JR
                                           Z, NXTLIN
                                                              DOES THE CHARACTER FROM THE
 7F35
                                                               ; SEARCH BUFFER (B) MATCH THE
 7F36 B8
                 00950
                                  CP
                                           R
                                                              ONE FROM INPUT? IF SO GO
 7F37 2809
                 00960
                                  JR.
                                           Z.MATCH1
                                                              HAVE WE PREVIOUSLY MATCHED
 7F39 3ADF7F
                 00970
                                  LD
                                           A, (MTCHFL)
                                  CP
                                                               ; ANY CHARACTERS IN THIS LINE?
                 00980
 7F3C FE00
                                                              ; IF NOT, GET THE NEXT CHAR
                  00990
                                           Z.NXCHAR
 7F3E 28F0
                                                                                     Listing 1 continues
```

```
Listing 1 continued
7F40 18F1
                                              RUPFI
                                                                   ; IF SO, GO TO BUFF1 : WHEN THE FIRST CHAR MATCHES
                  91999
7F42 3E01
                  01010 MATCH1
                                    LD
                                              A . 1
7F44 32DF7F
7F47 13
                                                                   ; SET THE MATCH FLAG AND
                  01020
                                    LD
                                              (MTCHFL),A
                  01030
                                    TNC
                                                                   ; POINT TO THE NEXT CHARACTER
7F48 18EØ
                                                                   ; AND GO TO BUFFNX
: TAKE THE VALUE OF THE NEXT
                                              BUPPNY
                  01040
                                    AT.
                  01050
                                              HL, (NXTADD)
7F4A 2ADD7F
                         NYTI.IN
                                    T.D
7F4D 18B5
                  01060
                                                                   ADDRESS AND GO
                                              NWLINE
                                    JR
                  01070
                  01080
                          ROUTINE WHEN A COMPLETE MATCH HAS BEEN FOUND
                  01090
7F4F DD2ADB7F 01100
                         MATCH
                                    T.D
                                              IX. (PRSADD)
                                                                   GET THE PRESENT ADDRESS
                                    INC
7F53 DD23
                                                                   AND MOVE OVER TO THE
                  01110
                                              IX
7F55 DD23
                  Ø1120
                                                                   PROGRAM LINE NUMBER
                                    INC
                                              IX
7F57 DD6E00
                  01130
                                                                   GET THE LOW AND HIGH BYTES
                                    LD
                                              L, (IX+0)
7F5A DD6601
                  01140
                                    LD
                                              H, (IX+1)
                                                                   OF THE LINE NUMBER
7F5D CDAFØF
7F6Ø 3E2Ø
                  01150
                                    CALL
                                              ØFAFH
                                                                   OUTPUT THE LINE NUMBER
                  01160
01170
                                    LD
                                              A,32
32AH
                                                                   GET A SPACE CHARACTER
7F62 CD2A03
7F65 21E841
                                                                   AND OUTPUT IT
                                    CALL
                  01180
                                                                   POINT TO THE INPUT BUFFER
                                              HL,41E8H
                                                                   ;OUTPUT THE LINE
;GET A CARRIAGE RETURN
                                              2B75H
7F68 CD752B
                  Ø119Ø
                                    CALL
7F6B 3E0D
                  01200
                                    LD
                                              A,13
7F6D CD2A03
                  01210
                                    CALL
                                                                   ; AND OUTPUT IT
:GET CHARACTER FROM KEYBOARD
                                              32AH
7F70 CD4900
                  01220 LOOP
                                    CALL
                                              49H
                                                                   IS IT THE "ENTER" KEY?
7F73 FE0D
                  Ø123Ø
                                    CP
                                              13
7F75 28D3
7F77 PE01
                  01240
01250
                                                                   ; IF SO, CONTINUE THE SEARCH
; IS IT THE "BREAK" KEY?
                                    JR
                                              Z, NXTLIN
                                    CP
                                                                   ; IF SO, START OVER
; IS IT SHIFT UP ARROW?
7F79 CAA67E
                  01260
01270
                                    JP
                                              Z,START
7F7C PE1B
                                    CP
7F7E CA191A
                                                                   ; IF SO, RETURN TO BASIC
                  01280
                                    JP
                                               2,1A19H
                                                                   ; IF NONE OF ABOVE, TRY AGAIN
; POINT TO MESSAGE 3
7F81 18ED
7F83 21CA7F
                  01290
                                    JR
                                              LOOP
                  01300
                         THRU
                                    LD
                                              HL, MSSG3
                                                                   ;*CHANGE THE OUTPUT DEVICE TO
;*THE SCREEN
7F86 AF
7F87 329C48
                  01310
                                    XOR
                                              (409CH),A
                  01320
                                    LD
7F8A CDA728
7F8D 3E0D
                  01330
01340
                                    CALL
                                                                   OUTPUT MESSAGE 3
                                              28A7H
                                              A,13
                                                                   GET A CARRIAGE RETURN
                                    LD
7FBF CD2AØ3
                  01350
                                    CALL
                                              32AH
                                                                   AND OUTPUT IT
                                                                   GET A CHARACTER FROM KEYBOARD; IS IT THE "BREAK" KEY?
7F92 CD4900
                  01360
01370
                          THRUIN
                                    CALL
                                              49H
7F95 FE01
7F97 CAA07E
                                    CP
                                                                   ; IF SO, START OVER
; IS IT THE SHIFT UP ARR W?
; IF SO, GO TO BASIC
                                              Z,START
                  01380
01390
                                    JP
7F9A FE1B
                                    CP
7F9C CA191A
7F9F 18F1
7FA1 4F
                  01400
01410
                                              Z,1A19H
                                               THRUIN ; IF NONE OF ABOVE, TRY AGAIN OUTPUT TO PRINTER (Y/N)? ,*
                                    JR
                  01420 MSSG1
                                    DEFM
7FB9 00
                  01430
01440 MSSG2
                                    DEFB
7FBA 45
                                                ENTER STRING:
                                    DEFM
7FC9 00
                  01450
                                    DEFB
7FCA 53
                  01460 MSSG3
                                               STRING NOT FOUND
                                    DEFM
7FDA 00
                  01470
                                    DEFB
7FDB 0000
                  01480 PRSADD
                                    DEFW
7FDD 0000
                  01490
                          NXTADD
                                    DEFW
7FDF 0000
                  01500
                          MTCHFL
                                    DEFW
7FE1 0000
                  01510
                          BUFFER
                                    DEFW
                                     END
7E96
                  01520
                                              START-18
00000 TOTAL ERRORS
```

to POKE the machine language program into memory.

The first version (see Program Listing 2) is the same as the assembly program. With the

other version you cannot use the printer and it's shorter (see Program Listing 3).

With either version, set the memory size to the value shown

in the first remark and type the program.

When you run the program, you first get a poor man's cyclical checksum of your data. This checks for typographical indiscretions and transpositions. If you pass this check you should be in good shape.

When the program completes its run and returns the ready prompt, try a few searches on the Basic program that POKEd in the data.

Assuming that works, save your Basic program on tape, and it's ready for serious use.

# Tips on Using the Utility

Remember that in Basic only the first two letters are significant. Suppose you want to introduce a new variable to hold the last value input, and you want to call it Last. Search only for LA, but bear in mind the program will also find a variable named Large. Remember, defining too large a search argument will cause you to miss conflicting variables that have the same first two letters.

Watch out for embedded blanks. A search for:

# PRINT @ 660

will not find:

PRINT @ 660

You can search for references to line numbers too. Suppose you plan to delete lines 1120 to 1180 from your Basic program. Before you do so, you can quickly find out whether any GOTOs, GOSUBs or If...Thens reference these lines by searching for 11. Any reference will quickly show up.

Try this utility to soothe your frustrations, and speed your way through your next Basic programming job. ■

```
18 ' MEMORY SIZE = 32415
28 ' LINES 38 TO 118 DO THE CHECKSUM DATA VALIDATION
39 DEFINT D, 2: CHECKSUM = 8
48 FOR K = 1 TO 7 STEP 2
58 READ D
68 IF D = -1 THEN 188
79 CHECKSUM = CHECKSUM + D * K
80 NEXT K
98 GOTO 48
189 IF CHECKSUM <> 116785 PRINT "CHECKSUM ERROR--RECHECK DATA ST
ATTEMETS": END
110 PRINT "DATA CHECKSUM OK"
128 ' LINES 138 TO 138 POKE THE MACHINE LANGUAGE INTO HIGH NEHO
RY
139 RESTORE
148 K = 32416
150 IF D = -1 THEN 218
150 READ D
150 R
```

```
10 ' SET MEMORY SIZE TO 32485
20 ' LINES 30 TO 110 DO THE CHECKSUM DATA VALIDATION
30 DEFINT D_K : CHECKSUM = 0
40 FOR k = 1 TO 7 STEP 2
50 READ D
60 IF D ~ -1 THEN 100
70 CHECKSUM = CHECKSUM + D * K
    80 NEXT K
    180 IF CHECKSUM <> 92158 PRINT "CHECKSUM ERROR--RECHECK DATA STA
TEMENTS": END
  118 PRINT "DATA CHECKSUM OK"
128 ' LINES 138 TO 198 POKE THE MACHINE LANGUAGE INTO HIGH MEMO
  RY
130 RESTORE
140 K = 32489
150 READ D
160 IF D = -1 THEN 210
170 POKE K,D
168 IF D = 1 THEN 218
178 POKE K,D
188 K = K + 1
198 GOTO 158
288 ' LINE 218 POKES THE JUMP ADDRESS OF THE "NAME" COMMAND
218 POKE 16783,233 : POKE 16784,126
228 PINT "FINSHED"
239 DATA 285,281,11,62,14,285,51,8,33,189,127,285
248 DATA 167,48,33,228,127,285,73,8,254,13,48,17
259 DATA 254,8,32,6,43,285,51,8,24,239,119,35
268 DATA 254,8,32,6,43,285,51,8,24,239,119,35
268 DATA 254,8,32,6,43,285,51,8,24,24,239,119,35
278 DATA 62,15,285,51,8,42,164,64,34,222,127,126
288 DATA 58,224,127,35,126,58,225,127,42,224,127,1-
299 DATA 181,254,8,48,189,42,222,127,7,55,58,226
302 DATA 255,126,43,33,232,65,17,228,127,175,58,226
316 DATA 257,127,175,184,449,31,126,254,94,49,21
328 DATA 35,124,48,9,58,246,127,254,84,48,24
330 DATA 225,621,156,226,127,19,24,224,127
340 DATA 24,176,221,42,222,127,221,35,221,35,221,318
358 DATA 24,176,221,42,222,177,221,35,221,35,221,318
358 DATA 33,232,65,285,117,346,21,35,227,35,225,33
378 DATA 33,232,65,285,117,345,21,328,242,3
388 DATA 22,202,122,824,237,33,285,712,285,112,285,167,46
399 DATA 62,15,285,42,3,285,73,8,254,1,262,233
488 DATA 22,202,122,8,24,237,33,285,712,285,112,285,167,46
399 DATA 62,15,285,42,3,285,73,8,254,1,262,233
488 DATA 22,202,128,84,82,77,78,77,58,32,32,0
428 DATA 05,54,82,73,78,71,32,78,79,84,32,78
428 DATA 05,54,82,73,78,71,32,78,79,84,32,78
428 DATA 05,54,82,73,78,71,32,78,79,84,32,78
428 DATA 05,54,82,73,78,71,32,78,79,84,32,78
```

Program Listing 3. Basic Version Without Print Option

# SCM

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Kenneth J. Bigelow 4117 55th Avenue Bladensburg, MD 20710

After spending three days keying in a new adventure program, to protect it you CSAVE it before running it. A long program saves in half an hour. When you come back, Ready is prompting and the computer awaits you.

With the program on tape you are protected. Right? Even if it crashes, you have taped it. Right? Maybe. Before you power down or run your program, you check the recorded tape using CLOAD? to play back the tape and compare it with what is still in memory. That will tell you whether or not your program was correctly recorded. If it's not, you'd better CSAVE it all over before you turn off the machine—you don't want to key it in by hand all over again!

If you already CLOAD? your tapes right after recording that's a good start. So once again you type CLOAD? and knowing that it will take just as long to check the tape as to record it, you leave to do something else for another 30 minutes. But when you get back, the screen says Bad just above the Ready prompt. A guick check of the recorder shows that the tape only ran for two minutes before the computer found a mistake on the tape. You rewind the tape and CLOAD? again. This time you watch while the computer starts its check. Sure enough, two minutes later, the message Bad appears and the tape stops.

Well, maybe the head is dirty. It has been a while since you cleaned it. Out comes the head cleaner tape, the goo and the swabs. Then, your tape goes back in and you CLOAD? again. Two minutes later Bad appears again and the tape stops. This time, you decide the recording was bad, probably due to the dirty heads. So, you rewind the tape and CSAVE the program again. Another 30 minutes later you rewind the tape, cross your fingers and CLOAD? one more time. You say a prayer in computer language and watch the screen anxiously. But no luck. Two minutes later Bad appears once more and there does not seem to be anything you can do

# **Tape Dropout**

The problem is "dropout" on the tape. A dropout is a spot where the magnetic medium is thinner than necessary, or absent altogether. That spot on the tape can hold no data. In ordinary audio use, this spot would go unnoticed. But the pulses used by the TRS-80 are very narrow and must occur in the right places. If one of those pulses occurs right on the dropout it is not recorded. On playback, the computer spots the missing pulse because it does not match the contents of memory. At that point the CLOAD? operation stops, indicating a bad tape.

Can you prevent this? One way is to buy only certified cassettes. These tapes have been tested and are guaranteed to contain no dropouts. Unfortunately, they are also expensive. The next choice is top-of-the-line cassettes. These tapes are less expensive than certified tapes, and usually contain no dropouts. However, there is no guarantee, and you can expect an occasional defect.

Two options are available to you: buying the more expensive tapes or tolerating the occasional defective cassette. Neither option is particularly satisfying. Testing the tape before wasting time recording would solve the problem, but what do we look for? The computer does the hard part.

# Checking the Tape

Make a visual inspection. Turn the take-up spool past the blank leader and inspect the tape surface. Reject any tape that is even slightly rough. Some of the 3-for-a-dollar or 25¢ tapes might as well have been polished by a knurling tool and look more like alligator hide than recording tape. The abrasive surface will wear your tape heads early. I buy these cassettes if the housing is screwed together, well made, and if wheels guide the tape. I throw away the tape and splice a saved program into the empty housing. The tape itself is dreadful!

When you have a smooth tape surface, let the computer hunt for dropouts. The computer will write a pattern of 1's onto the tape and then read them back. If you receive a non-1 pattern on playback, the tape had a dropout at that spot. If only 1's read back the tape is OK.

To understand how this works, let's take a look at the format of data on the tape. Figure 1 shows how it works. The cassette output routine generates a series of clock pulses and tapes them. One such clock pulse is generated every two milliseconds (one millisecond is equal to .001 second). The pause is left for data pulses. If a 1-bit is recorded, a data pulse appears halfway between the pulses. If a 0-bit is recorded, no pulse appears between pulses. Therefore, if we record an all-one pattern, the tape places a pulse every millisecond. The tape speed in audio recorders is standardized at 17/8 inches per second. The computer will pulse at intervals of .001875 inch.

Since Basic is too slow for such operations, read and write routines must be in machine language. But having the main part of the program in Basic facilitates entry and running. Also, with Basic we can enter the program without a lot of POKEs, T-Bug, EDTASM or any other utility programs and get back and forth between Basic and the machine language subroutines with the USR function.

# Writing the Program

Now write the Basic program to generate the required machine language subroutines



michael shrayer's

# ocessing system word

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when run. The program should run whether the system is Level II Basic, Model III Basic or Disk Basic. The machine language portions should be relocatable; the computer decides where to put them as well as the Basic program. This eliminates POKE commands, because we don't know where to POKE either subroutine. These are character strings and VARPTR finds them. This works with the Model I or the Model III, using Level II or Model III Basic.

For Disk Basic to work, a DE-FUSR statement must replace the POKE statements. The USR call must also be modified. Either way, when character strings hold the subroutines anversion of Basic can place them into a memory location. This protects the Basic operation, whether you have reserved memory during initialization or not. Both subroutines automatically land in the reserved string space to be retrieved by the VARPTR function.

Listing 1 shows the final Basic program. In this program lines 10 and 20 contain the data (in decimal form) which generate the write and read subroutines. Lines 30 and 40 read these data lists and convert them into character strings W\$ and R\$.

Lines 50 and 60 ask whether the computer is to write or to read from the tape. Then they set M\$ equal to the selected subroutine. M\$ will be the character string executed as a subroutine.

In line 70 VARPTR locates M\$ in memory and sets the USR pointer to that address. VARPTR returns a memory address related to the variable name the VARPTR argument uses. With string variables, the VARPTR returns an address containing

the length of the string. The next two addresses contain the string address itself in memory. Therefore, VARPTR locates the subroutine in memory and we can POKE its address into the USR pointer (locations 16526 and 16527).

Line 80 indicates on screen that the computer accepted input and begins the required subroutine. The message is different for read and write; you can tell at a glance what the machine is doing.

Line 90 executes the USR call. The Radio Shack manual suggests a command like X = USR(0). However, any other command that can specify a function works as well. The Print key is easier to hit than X =. Besides, who needs to define another variable at this stage?

Line 100 closes the program loop. Execution repeats from line 50. Both subroutines stop any time you hit either Shift key. You can regain control without resetting. This permits you to stop checking a bad tape and start over.

### **Subroutines**

The Basic program provides the necessary man-machine interface and calls the appropriate machine-language subroutine. The machine-language subroutines prepare and check the tape. You need not enter these subroutines along with the Basic program. Part of the Basic program generates and stores these subroutines. Only the Basic program need be entered and run. The subroutine assembly listings explain how they work.

The write subroutine (see Listing 2) contains 20 bytes. After turning on the recorder and recording the leader and sync byte, the subroutine enters a

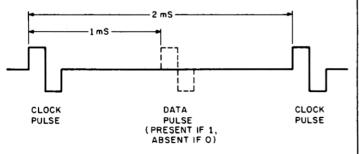


Fig. 1. The data format for TRS-80 tapes

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loop which writes hex FF (a pattern of eight 1 bits with their clock pulses) to the tape and then examines the Shift keys. If no Shift key is pressed the loop repeats from WCERT1 in the listing. This loop will continue in20 of the Basic program from 18 to 21.

# **Test Reliability Indicators**

We want assurance that the program is reading correct data from tape. A question mark for

# "Read and write routines must be in machine language."

definitely. The Shift key terminates the subroutine by turning off the recorder and returning to the Basic program.

When the Basic program reappears, it prints the digit 0 in response to the Print statement in line 90. It returns to line 50. Since line 50 starts with a CLS command, the zero will disappear, as soon as it is displayed and may even be invisible.

In the Model I TRS-80, the ROM routine CASSON turns on the recorder. If your system includes the expansion interface and you have two recorders, you may wish to preselect the recorder. Entering CASSON at address 0215H can avoid switching recorders. Change the second data element in line 10 of the Basic program from 18 to 21. The rest of the program remains unchanged.

In Model III Basic, CASSON is unnecessary. The CSHOUT routine writes the leader and sync byte to the tape, and turns on the recorder. However, the call to CASSON can remain. The Model III ROM essentially ignores such calls anyway. The only instructions executed by the Model III are XOR A followed by RET. Leaving the call to CASSON in place allows the subroutine to run directly on the Model I (Level II Basic) or the Model III (Model III Basic).

Listing 3 shows the read subroutine-RCERT. It is longer than the write routine (36 bytes) because it has to do more. CASSON turns on the recorder. Again, systems including two recorders may change the entry address to 0215H, by changing the second data element in line every wrong byte should show how good the tape is. In RCERT the HL register pair acts as a screen pointer and keeps the? code in register C.

Once the registers have been initialized, RCERT calls CSHIN in ROM. The leader code of the internal subroutine synchronizes to the clock pulses and checks for the sync code recorded earlier by CSHOUT. The computer will differentiate clock pulses from data pulses, and know where bytes end and begin. In the Model III, as with CSHOUT, CSHIN also activates the recorder.

The next step is to read and check data from the tape. Regardless of the tape's condition. it helps to verify that data was really transmitting from the tape. Since the TRS-80 normally uses the blinking asterisk in the upper right corner we can use the same method. There will be no end-of-line codes on the tape to blink the asterisk automatically, so let's blink it every 64 bytes for a nice steady display. Register B will be the counter and a DJNZ instruction will end the loop.

Now CSIN, the ROM routine, will read a byte from tape. If it is really hex FF we skip the error display code and go to RCERT3 in the listing. If another pattern than FF is recovered from tape the error code will signal. A question mark occurs at the location the HL register pair designates. Then L is incremented to advance the pointer to the next spot. This allows a maximum of 256 question marks (four lines). We could have more, but if the tape is bad you will know

by now. If the question marks exceed screen memory, they will overwrite regular memory and destroy all the Basic pointers and vector addresses. To avoid problems restrict the number of question marks.

# Stopping the Program

At RCERT3 the subroutine looks at the shift keys. As with WCERT, this stops the program any time the computer reads data from the tape. However, WCERT can stop whether or not the tape is moving. RCERT can only stop after a byte reads from tape. While the tape is moving there will be no problem. Once the tape stops RCERT will look for another byte until it gets one. It will check the shift keys again.

In the absence of a Shift, the DJNZ instruction is performed. Normally, this causes a branch back to RCERT2 which reads another byte. This loop repeats until 64 bytes (correct or not) are received from the tape. At that point the DJNZ falls through and the call to Blink will be executed. This ROM routine causes the righthand asterisk to blink on or off every 64 bytes. At 500 baud, this is about once a second. After the asterisk switches, a JR instruction returns the program to RCERT1, which reloads regisand type Run. "(W)RITE OR (R)EAD?" will appear. Load a tape and advance it past the blank leader. Press Play and Record. Now, type W (Enter). The display will change to "Press 'Shift' To Stop." A C-60 takes about 30 minutes to load.

A Shift terminates the subroutine and displays the original
message: "(W)RITE OR (R)EAD?"
Turn the cassette over and advance the tape to the end of the
blank leader. Place the tape back
in the recorder, press Play and
Record, and once more type W
(Enter) into the computer. Repeat
the process to record the test pattern on side two.

Shift ends the subroutine and returns to the Basic program. Return the tape to side one, load it and press Play and type R (Enter) into the computer. The computer displays "Reading", and the recorder starts. At the sync byte asterisks appear. The right hand asterisk blinks at about a one-per-second rate indicating that the computer is reading data. (The Model III blinks at its own rate.)

As long as the data is correct (All 1's, or hex FF's), the disolay will not change. If the display is blank except for the top line, the tape is good. If a pulse is missing, a question

"If a pulse
is missing,
a question mark
will appear
on the screen."

ter B before reading the next byte from the tape. This restarts the sequence.

The Blink routine is absent in the Model III. CSIN blinks the asterisk. This is why the asterisk blinks regularly on the Model III. As with CASSON, a call to Blink will do no harm. In fact, this location in the Model III consists of a JR to the same XOR A, RET sequence which replaces CASSON.

# Testing

To use the program, key it in

mark appears as indicated by a zero bit recovered from tape up to a maximum of four lines of question marks.

# **Leader Problems**

The first few seconds of the leader (composed of all 0's to insert the clock pulses) and the sync byte (hex A5) prevent checking this part of the tape as closely as the rest. Nevertheless, this code allows the computer to synchronize itself, byte for byte, with the data coming

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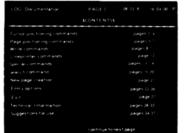
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in. Otherwise timing errors creep in and cause apparent faults where none exist.

If a few question marks begin the tape you need not discard the entire tape. Mechanical damage at one end or the other is common enough. To save the rest, note where the last question mark appears and delete that segment. Splice the remaining tape to the plastic leader. Usually, you will not lose more than 6 to 12 inches.

One to four question marks at the end, just as the plastic leader moves under the playback head, is usually caused by the last incomplete byte recorded previously, and noise generated at crossover. There is no cure for such difficulties; simply make sure you have enough tape to record your program.

# **Splicing**

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You can locate a single fault by pressing Shift as the question mark appears to stop the tape. Then delete the section and splice the ends together. (The splice desynchronizes the tape and appears as a defect. Always play the entire tape to determine the bad spots. If repair is worth it, locate the bad spot or you will have to re-record the entire tape to check the remainder.)

If multiple faults punctuate

the entire tape, clean the heads and pinch roller of your recorder. Dirty heads make even the best tape produce garbage. Also check playback volume. This is rather touchy with TRS-80's. The Model III needs a higher playback volume than the Model I. If your results are no better with clean heads and correct volumes, discard the tape.

# Sidestepping the Pitfalls

The certify program on the Model I TRS-80 is simple and straightforward. Be sure to record the program before you turn off the machine. The higher playback volume required by the Model III depends on clean heads and a good recorder even more than the Model I.

The tape can be written at 1500 baud, but playback is something else. If an error occurs and a question mark appears, the computer can lose synchronization with the recorded data. If this happens the slight extra time lag between bytes will foul up the playback timing for the rest of the tape. As a result, the computer will treat the entire tape as defective, even if it actually had only one bad spot which minor surgery could easily remove.

It takes thirty minutes to read or write each side of a C-60 cassette, whether the rate is 500 or

```
'CASSETTE TAPE CERTIFY PROGRAM
'WRITTEN BY KENNETH J. BIGELOW
  'WILL RUN ON ANY TRS-80 USING LEVEL 2 OR MODEL 3 BASIC. MUST BE MODIFIED FOR DISC BASIC.
  'DATA FOR WRITE SUBROUTINE.
10 DATA 205.18.2.205.135.2.62.255.205.100.2.58.128.56.183.40.245
   'DATA FOR READ SUBROUTINE.
20 DATA 205,18,2,33,8,61,14,63,205,150,2,6,64,205,53,2,254,255,4
   'PUT SUBROUTINES INTO MEMORY AS CHARACTER STRINGS.
   CLEAR150:w$="":FORI=1TO20:READW:W$=W$+CHR$(W):NEXT
R$="":FORI=1TO36:READR:R$=R$+CHR$(R):NEXT:RESTORE
   'GET FUNCTION FROM USER.
   ...
CLS:INPUT"(W)RITE OR (R)EAD";AS:MS=WS:IFAS="W"THEN78
MS=RS:IFAS<>"R"THEN58
   'AT THIS POINT, M$ CONTAINS THE ACTUAL SUBROUTINE TO BE RUN. VARPTR IS USED TO FIND IT AND SET THE USR POINTER.
   POKE16526, PEEK (VARPTR(MS)+1): POKE16527, PEEK (VARPTR(MS)+2)
CLS: IFAS="W"THENPRINT" PRESS 'SHIFT' TO STOP. "ELSE PRINT" READI
   'EXECUTE THE SELECTED SUBROUTINE.
   PRINTUSR(0)
98 'AFTER TERMINATING SUBROUTINE, ASK FOR NEW COMMAND.
100 GOTO 50
                              Program Listing 1
```

1500 baud. 500 baud helps ensure greater reliability when running this program.

Regardless of which machine

you use, keep the program to run whenever your computer is idle. It might just as well be testing tapes.

	66116 66126	THIS R	SUBROUT OUTINE	INE FOR TAPE ( IS ENTIRELY RI	CERTIFY PROGRAM.
	66136	,			<b></b>
			SSETTE	BANDLING ROUT	(NES ARE IN ROM:
	00150				
<b>61</b> F8	99169	CASOFF	EQU	<b>01</b> P8H	; TURN RECOR
ER OFF.					
8212	99178	CASSON	EQU	0212H	TURN RECOR
ER ON.					
# 26 4	00180	CSOUT	EQU	Ø 26 4H	; WRITE (A)
O TAPE.					
0287	88198	CSHOUT	EQU	#287H	;WRITE LEAD
R/SYNC BYTE.					
	09200				
	00210	,			CURCUS MUR SUTE
	99 2 2 B	; TO TER	MINATE,	THIS ROUTINE	CHECKS THE SHIF
KEYS AT				10 DD0000D	, THE ROUTINE RE
	99238	; ADDRES	P 3886H	. IF PRESSED	, THE ROUTING RE
URNS TO	****	BASIC.			
8888	88258 88268		ORG		DUMMY STAR
ING ADDRESS.	00200		UNG	•	, Donais Dira
#### CD12#2	44274	WCERT	CALL	CASSON	START RECO
DER.	992/8	MCDKI	CALL	CASSON	, ornar kbco
9963 CD8762	86288		CALL	CSHOUT	WRITE LEAD
R & SYNC.	88208		CADD	CBIIOCI	,
0006 3EPP	44204	WCERT1	T.D	A. OFFE	:USE ALL 1'
AS PATTERN.	39439	HUDRII	30	,	, , , , , , , , ,
0008 CD6402	00386		CALL	CSOUT	:WRITE BYTE
TO TAPE.					,
000B 3A8038	66316		LD	A, (3889H)	CHECK SHIP
KEYS.				, ,- 3,	,
SSSE B7	00320		OR	A	; SHIFT KEY
RESSED?				-	
998P 28P5	00330		JR	2,WCERT1	; IF NOT, RE
EAT LOOP.					
9911 C3F891	66348		JP	CASOFF	; RECORDER O
F AND RETURN,					
	99358	;			
9999	88368		END		

Program	Listina	2

	99196 11	READ SU	BROUTINE	FOR TAPE CERTIF	Y PROGRAM.
	00125 ;	THIS RO	UTINE IS	S ENTIRELY RELOCA	TABLE.
	99130				
	66146 ;	ALL CAS	SETTE HA	ANDLING ROUTINES	ARE IN ROM.
	00150 ;				
Flps Er opp.	00168 C	ASOPP	EQU	●1F8E	TURN RECORD
8212	66176 C	CCON	BQU	0212H	
ER ON.	C	na ave	PAn	-212n	TURN RECORD
022C	06188 BI	LINK	EQU	●22CH	BLINK RIGHT
ASTERISK. Ø235	<b>66100</b> 00				
FROM TAPE.	66198 CS	SIN	EQU	●235H	READ A BYTE
0296	88298 CS	SHIN	EOU	<b>0</b> 296H	READ HEADER
/SYNC BYTE.					, NORD BEADER
9959	88218 ; 88228		ORG		DUMMY START
ING ADDRESS.	55225		O.N.O	•	, 201211 021211
8888 CD1282	00238 R	CERT	CALL	CASSON	;START TAPE.
0003 21003D	66248		LD	HL,3D99H	POINT TO VI
DEO LINE 5.					•
9996 ØE3F	99259		LD	C,'?'	PREPARE QUE
STION MARK.	00260		CALL	CSHIN	WAIT POR SY
NC BYTE.	00200		CALD D	00011	,
000B 0640	89278 R	CERT1	LD	B, 64	BLINK EVERY
64 BYTES.	44280 R	cunm?	CALL	CSIN	READ A BYTE
000D CD3502	98289 M	CBRTZ	CALL	CSIN	INDAD & BILE
<b>9818 FEFF</b>	88298		CP	OPPH	; IS IT ALL 1
'8?					
8612 2882	00300		JR	Z,RCERT3	; IP SO, PINE
<b>9</b> 814 71	00310		LD	(HL),C	; IF NOT, PRI
NT OUT	00320		INC	L.	A QUESTION
0015 2C MARK.	00320		INC	<b>D</b>	IN GORDITON
0016 3A8038	00330 R	CERT3	LD	A, (3888H)	LOOK FOR SE
IPT KEY.				_	
0019 B7 001A C2F861	0034 <del>0</del> 00350		OR JP	A NZ,CASOFP	;PRESSED?
	•••		••	,	, 55, 6511
SSID 192E	00360		DJNZ	RCERT2	REPEAT LOOP
64 TIMES.	44374		CALL	BLINK	BLINK ASTER
SSIF CD2CS2	00370		CALL	DLINK	JOULNE ROTEK
9922 18E7	88388		JR	RCERT1	REPEAT INDE
PINITELY.					
	99390 ;		-		
9999 99999 TOTAL	99499 Errors		end		
DADAG TATUT					

Program Listing 3

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# Another Sort of Sort

Karl L. Townsend 103 Knollwood Drive Lansdale, PA 19446

Sorting plays a large role in programming data base files such as mailing or telephone lists. With few exceptions most data base applications require data sorting according to some prearranged plan.

```
Joe
   Sam
   Andy
   Ted
         10
   Mac
         8
   Bill
   ΑI
8
   Fred
9
   Lou
10
   Ed
  Fig. 1
```

Most of us started using the bubble sort because it is so simple and quick to program. As we learned more about programming and realized the bubble sort's lack of speed and its inefficiency, we moved on to other methods such as the Shell, and the Heap Sort.

Most sorts move data from location to location as the sort progresses. This very movement of data carried to an extreme makes the bubble sort so poor.

If you do much relocating or exchanging string data, the TRS-80 is likely to go into "mumble mode" while clearing its head. The TRS-80 locks up everything while it rearranges the string space and rids itself of unnecessary strings. You can reduce these effects by clearing additional string space or by us-

ing the VARPTR instruction for your exchanges. But why move the data at all?

How about a method of sorting without moving data out of its assigned storage location? This solves the string clearing problem, and also avoids excessive writing and rewriting of data files. Position sorting and chaining may be for you.

# **Position Sorting**

To start, we will experiment with a few routines to look at a list of data elements and record their relative positions in a file, in this case, an array. Program Listing 1 shows a short program to do just this. The program consists of three parts. The first section, lines 100–120, reads names to be sorted into the A\$ array.

Since we are not going to move the original data, we must keep track of our sort. Array C(x)

Al

Fred

Lou

Sam

Fig. 2

2 Andy 3 Bill

4 Ed

6 Joe

8 Mac

10 Ted

accepts and stores the numerical position of records once they are sorted. This array, the same size as our data array, has a storage position to match each data item in the main storage array. Lines 200–220 preset this position array to all ones, preparing it for the sort.

Lines 230-270 contain the sort. The test sort is set up to arrange data in ascending order. As the sort progresses, each data item is compared against each of the others. Size, as used here, means relative alphabetic position. For example, B is larger than A, and Fred is larger than Andy. If a given data item is larger than the one against which it is being compared, the sort adds a one to its equivalent position in the C array. This process is called incrementing. Larger items are incremented in the C array more often than smaller items. The largest data item is incremented every time it is compared; the smallest, never incremented, remains a one.

Lines 900-930 form a simple print routine enabling us to see the results of our labors. If you have no printer, change all LPRINT instructions to Print to show output on the screen.

Type in the program in Listing

1. Figure 1 shows the result of our sort. Column one lists the

```
18 REM POSSORT/V81
108 FOR I = 1 TO 18
118 READ AS(I) 'READS IN TEST NAMES FROM DATA LIST
128 NEXT I
208 FOR I = 1 TO 18
218 C(I) = 1 'PRESETS POSITION COUNT ARRAY TO ALL ONES
228 NEXT I
238 FOR I = 18 TO 2 STEP -1 'START SORT
248 FOR J = I-1 TO 1 STEP -1
258 IF AS(I) => AS(J) THEN C(I) = C(I) + 1 ELSE C(J) = C(J) + 1
268 NEXT J
278 NEXT I 'END SORT
988 FOR I = 1 TO 18
918 LPRINT I, AS(I), C(I)
928 NEXT I
938 LPRINT
1898 DATA JOE, SAM, ANDY, TED, MAC, BILL, AL, FRED, LOU, ED

Program Listing 1
```

consecutive positions of the data in the arrays. Column two lists data as read from the data statement. But take a look at column three. These numbers in sequence from 1 through 10 indicate the sorted position of their associated data elements. If we read through the array based on the sequence shown in column three, we are reading the data in ascending order. We have kept our promise; the original data is unchanged in position or order.

We can now print the data in sorted order. Add the following lines to your original program.

```
950 FOR I = 1 TO 10 'PRINT DATA IN

ASCENDING ORDER

960 FOR J = 1 TO 10

970 IF C(J) = I THEN LPRINT I, A$(I)

980 NEXT J

990 NEXT I
```

As the program runs, you will again see the output in Fig. 1. However, immediately following it is the list of names printed in ascending order (see Fig. 2).

This print routine is a rather poor one. Although the large amount of time is not obvious with this small file, the procedure is very slow on a larger one. If you analyze the nested loops, you will see that the entire list of 10 items is read each time one item is printed. The computer searches for a match in the Carray for each print. This can be speeded by jumping out of the inner loop as soon as a print is completed, but on the average, the computer reads half of the entries for each print. To print a file of 10,000 data items would require about 500,000 reads. We need a better way to print or a different sort.

# Chaining

Chaining lets us jump from

```
Joe
2
    Sam
3
                6
    Andy
            2
4
    Ted
           10
                0
5
    Mac
            8
                2
    Bill
            3
6
               10
7
    ΑI
                3
   Fred
8
            5
                1
9
   Lou
                5
10
   Ed
            4
                8
      Fig. 3
```

one record to the next higher one as we print without extensive searching. We only need to read each record once to print it. Add the following statements to your program:

```
600 X = 0

610 FOR I = 10 TO 1 STEP-1

620 FOR J = 10 TO 1 STEP-1

630 IF C(J) = I THEN X(J) = X: X = J

640 NEXT J

650 NEXT I
```

Also, change line 910 to:

910 LPRINT (, A\$(1), C(1), X(1)

Delete lines 950-990. Now run.

Figure 3 shows the result. The first three columns remain the same; a fourth column depicts the X array containing the chaining information. The numeral 3 beside Al's name says that the next record (Andy) is found in array position 3. At this location, column four says to go to position six where we find Bill. If you trace each link of the chain, you will arrive at Ted. A zero in the chaining column indicates the end of the file.

it appears that we can now step through the file from record to record in ascending order without any exchanges. We still have a problem, however: How do we get to Al's record to begin the sequence? Since it is unlikely that the first physical record is the first in the sort order, let's

insert a dummy record which will always be first. In this case, use the name AAA since no normal English word will sort before it.

Change Joe in line 1000 to AAA, leaving the rest of the names as they are. Now run again.

Figure 4 shows the result. AAA is the first record; its chaining number (seven) leads right to AI. Trace the chaining numbers and you will step through the entire file, ending with Ted and a zero to indicate end of file.

To print the names in sequence from this chaining information add the following lines to your program:

```
950 T = X(1)

960 FOR I = 1 TO 9

970 LPRINT I, A$(T)

980 T = X(T)

990 NEXT I
```

On running again, you will see the same data, followed by the file printed in ascending order.

Let's review the additions we just made. Line 950 takes the chaining information from the dummy record and saves it in variable T. Line 960 begins the print loop. Note that it only goes from 1 to 9 as we do not want to print the dummy record. Line 970 is the print line. On the first time through the loop it prints A\$(T), the first record as directed by the chaining information. The key to the chained print, however, is in

line 980; T is set equal to the next link in the chaining column. This process continues until all records are printed in order.

# **Bubble Sort or Chain Sort?**

I decried the bubble sort as slow and inefficient. It appears at this point that the chain sort procedure is even worse. More programming is required to support the sort, and data is more difficult to print.

Have we really accomplished anything?

Are there any advantages to the chain sorting procedure? Figure 5 shows information on 10 people. Suppose we want to print three different listings of this data: name order, city order, and state order. Normally this requires sorting into each order wanted and then printing. If later you need a print in another order, you must sort again. How can we apply the techniques just learned to this type of situation?

First, we generate a dummy record to precede the file. We insert the record AAA before the first entry in each column. Enter the program shown in Program Listing 2.

To make things easier when printing our file, the program provides a multidimensioned array to contain the data. Line 100 dimensions A\$ to 20 rows and 3 columns. I allowed for a few extra lines in the array in case you

```
18 REM POSSORT/V86
188 DIM A$(28,3), C(28), X(28,3)
118 FOR I = 1 TO 1
128 FOR J = 1 TO 3
128 HEAD A$(I,J) 'READ IN TEST DATA
148 NEXT J
158 NEXT I
298 FOR I = 1 TO 3 'SORT COLUMNS IN ORDER
218 FOR J = 1 TO 11 'PRESET C ARRAY TO ALL ONES
228 C(1) = 1
236 NEXT J
 248 FOR K = 11 TO 2 STEP -1 'START POSITION SORT

258 FOR L = K-1 TO 1 STEP -1

268 IP A$(K,I) => A$(L,I) THEN C(K) = C(K)+1 ELSE C(L) = C(L)+1
 274 NEYT
 298 X = 8

368 FOR K = 11 TO 1 STEP -1 'CHAIN COLUMN

318 FOR L = 11 TO 1 STEP -1

328 IF C(L) = K THEN X(L,I) = X: X = L: L = 1
 336 NEXT
        NEXT 1
 488 INPUT TO PRINT BY NAME -ENTER 1. BY CITY -ENTER 2. BY STATE -ENTER 3":P
 428 POR I = 1 TO 18
438 LPRINT A$(T,1), A$(T,2), A$(T,3) 'PRINT ROUTINE
       T = X(T,PR)
 450 NEXT 1
 469 GOTO 488
 1666 DATA AAA,AAA,AAA,JONES,MORRISVILLE,PA,BROMN,PHILADELPHIA,PA,SMITH,CAMD
EN,NJ,GREEN,TRENTON,NJ,OTIS,PHILADELPHIA,PA
 1818 DATA TALL, LANSDALE, PA, BROWN, PHILADELPHIA, PA, ARNESS, BUFFALO, NY, JAMES, TR
ENTON, NJ, SAMPSON, DOVER, DEL
                                                 Program Listing 2
```

want to include additional test data. Since we will sort on all three columns, array X is also dimensioned to 20 by 3. Remember, the chaining array must provide a position to match each data key on which a sort is made.

Lines 110-150 read the test data into the A\$ array using nested loops. Each time the I loop is incremented by one, the J loop reads in three data items: name, city and state.

Line 200 starts the sort. The program steps through each of the three columns in order. When I equals one, the names

are sorted; on two, the city; and on three, the state.

Lines 210-230 preset the position array to all ones just before each column is sorted.

The position sort itself is in lines 240-280. We are now working with two-dimensional arrays. The first time through the sort, the I in each array is a one; all sort comparisons are based on the first column of data (names). Subsequent sorts change this to a two and then a three to sort by city and state.

Lines 290-340 chain the data as before except that the chaining information is stored in the multidimensional array X. The I loop controls chain storage to correspond with the data column being sorted.

In this area, I added another small change at the end of line 320. L equals one sets the loop counter to the loop end count when a find is made. When the Next L statement is reached, the program jumps out of the loop. This avoids cycling through the loop after a find has already been made and the chain number has been stored in the X array. On a large file, this is a significant difference; it cuts the average time in this loop by about one-half.

Line 400, a mini-menu, allows you to select the column you want sorted. The print routine is as used before except that you can select the chaining column for the particular print requirements.

The program will hesitate while reading in the data and performing the sorts. When the prompt line for printing appears, try each option. You can print, in order, any of the three columns without re-sorting the data.

This ability to print in various sequences without re-sorting is an asset in large files. In the multiple sort situation chained files really shine.

To save your sort information, just save the chaining information right along with your data. This enables you to print data in your selected sequence next time you use the file. Use

the following routine:

800 FOR I = 1 TO 11 810 PRINT # - 1, X(I,1), X(I,2), X(I,3), A\$(I,1), A\$(I,2), A\$(I,3) 820 NEXT I

I have developed some of the concepts of chaining and data sorting without rearranging a file. The somewhat crude and unsophisticated examples should demonstrate possible applications for your programming efforts.

Karl Townsend works on system interfaces on the Navy Aegis program for RCA.

1	Jones	Morrisville	PA
2	Brown	Philadelphia	PA
3	Smith	Camden	NJ
4	Green	Trenton	NJ
5	Otis	Philadelphia	PA
6	Tall	Lansdale	PA
7	Brown	Philadelphia	PA
8	Arness	Buffalo	NY
9	James	Trenton	NJ
10	Sampson	Dover	DE
	F	ig. 5	

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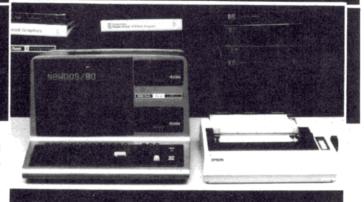
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**~**58

Level II Basic Model III

# Modify Uni-Key for your Mod III.

# Autokey

Don Rigg 17 Bittersweet Bay Winnipeg, Manitoba Canada

member of my TRS-80 user's group recently showed me a most remarkable program. A Basic keyword appears whenever he presses the shift key in combination with any other key. The program is called Uni-Key, by Rowand Archer, Jr. of Hillsborough, NC. It appeared in the September 1980 issue of 80 Microcomputing.

The program should run on my Model III, but it most inconveniently uses a lowercase letter for generating the keywords. This works well on the Model I, as a shifted character is indeed lowercase. In my case I was usually generating lowercase letters and the Shift produced uppercase. I would have to do all my typing holding down the shift key (except when I wanted a keyword) or keep using the shift 0 uppercase only toggle. Neither solution was very satisfactory, so I customized Uni-Key for the Model III and included a few other worthwhile features.

My version of Uni-Key gives you an alternate keyboard layout which generates the keywords when you press the shift key. You can also turn the special keyboard off to revert to normal upper and lowercase typing. When in keyword mode all the words shown in Fig. 1 are available at the touch of only one letter key. (You can substitute Assembly language or Pascal keywords for the Basic keywords.)

I designed Fig. 1 so you can copy it onto a file reference card and keep it at your keyboard. The dashed lines associate keywords with letter keys.

# **Design Specifications**

My Autokey program has the following features: It retains the original Uni-Key concept of using the shift key to generate keywords; it uses additional control keys on the

Model III by pushing shift, down arrow and a letter key. You can turn the routine off to return to the regular keyboard. A routine automatically sets the memory size, another executes the program as soon as it reads in the tape, and a third starts the computer with the all caps switch off rather than on as is usual.

The program changes lowercase characters to uppercase; its logic assigns keywords whenever you press an uppercase or control character.

My program includes a routine which you can execute via System. This routine resets all Basic control pointers, allowing you to re-access a Basic program if you in-advertently type New or CLOAD when you mean CSAVE.

Two keys to understanding this program are the functions of the keyboard device control block, and ASCII code.

# **Device Control Block**

The computer often executes a ROM routine which looks at the keyboard to see if you have pressed a key. That is why the computer reacts so quickly when you do. At one point in this routine it looks at an address pointer in RAM for where to go next. This provides you with an opportunity to tell the computer where to go (see Fig. 2). By changing this address you will successfully intercept part of the computer's operating system (its brain); you can easily fool it into changing things around.

As you intercept each character on its way from the keyboard to the Basic interpreter, you can change some of them to suit your new purposes.

# **ASCII Coding Structure**

The computer stores alphanumeric information in its memory in ASCII (American National Standard Code for Information Interchange).

In a TRS-80, the keyboard scan routine looks at a collection of wires between mem-

ory addresses and the physical keyboard. Voltages change when a key has been pressed; the changes are then translated into the proper ASCII value and put into the A register.

# **Changing Characters**

Look at the code outlined in the ASCII tables in the Model III reference manual (Appendix C in mine) and notice that all control characters (shift, down arrow, character) are grouped from code numbers 01H to 1FH. Similarly, all uppercase characters are grouped from 41H to 5AH, while the lowercase characters run from 61H to 7AH. Notice that lowercase characters are coded exactly 20H higher than the corresponding uppercase letters. This symmetry proves very valuable. For example, you can change a lowercase b (62H) to uppercase by subtracting 20H.

My program leaves the control characters alone and looks up keywords numbered 01H to 1FH (the first 31). It subtracts 21H from the codes for an uppercase letter; they continue the number sequence immediately after the control codes. Capital A with a code of 41H becomes 41H – 21H, or 20H (next in the sequence above 1FH). The program changes lowercase characters to uppercase by subtracting 20H whenever you input one from the keyboard. All other codes remain unchanged.

# **Assigning Keywords**

I developed Fig. 1 when I assigned keywords to keys. I grouped the keywords near the key of the same letter so you can find them easily. You can easily change the sequence or the words to whatever you want.

After I developed the keyboard layout, I put words into sequence with ASCII codes so I could put them in the right order in the program. The numeric listing is shown in Fig. 3. You will find this useful if you want to change the words. I reserved several control codes because some control functions per-

# "A Basic keyword appears whenever he presses the shift key in combination with any other key."

form their usual functions (Enter, backspace, and so on). Here also, you can bypass codes if you like.

# **Program Structure**

After I established the basic structure for the keywords I prepared a flowchart (see Fig. 4) to give a broad overview of the main program functions.

To use the flowchart start at the top left and follow the arrows based on the answers you get at a diamond-shaped box.

There are four separate modules. Module 1 has an ORG of 41E2H, in System RAM. It changes an address pointer referred to (called) by a ROM routine just after it has loaded a System tape. It gives the program the Auto Start feature.

Module 2 is used just once to set the pointers and flags and to change the address in the Keyboard Device Control Block (DCB) so the new routine will be used. Completely automatic, it resets the address pointer changed in Module 1 so the computer operates normally if you load another

System tape.

Module 3, the main part of the program, determines which key you pressed and whether to take any special action.

Module 4 is the stand-alone routine to restart a Basic program.

### The Program

Program Listing 1 contains the Assembly language version of the program. It is set up to run in a 16K cassette-based system but, by changing the ORG at lines 320 and 2860 and the memory size values in lines 410 and 430, you can run the program in any size memory.

Program Listing 2 is a Basic language routine which POKEs the same program into memory and executes it.

The program is written in the same sequence as the flowchart in Fig. 4. Lines 410-450 limit the amount of memory Basic will use so it does not destroy this program. (If you want to change this, set the value in line 410 to the highest address you want Basic to use minus 2. Set line 430 to the

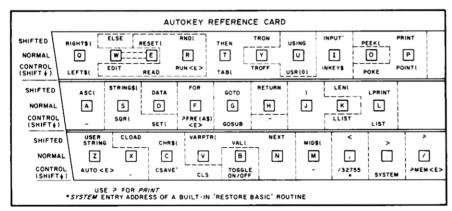


Figure 1

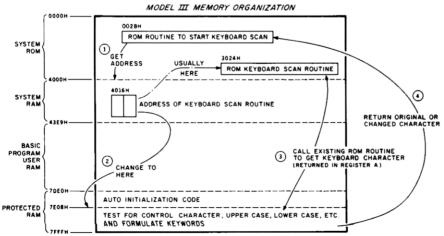


Figure 2



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50 00 00 ea <b>00</b>	Diskettes—10 per b Verbatim— 51/4" SSDD 51/4" DSDD Maxell—51/4" Elephant by Leading Edge Disk head cleaners— VR Data (51/4")	\$23.95 \$39.95 \$34.95 \$22.95 \$14.95 \$7 \$29.95
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50 00 00 ea <b>00</b> 00 00 00	Diskettes—10 per b Verbatim— 51/4" SSDD 51/4" DSDD Maxell—51/4" Elephant by Leading Edge Disk head cleaners— VR Data (51/4") Verbatim 51/4" or 8 51/4" plastic library cas	\$23.95 \$39.95 \$34.95 \$22.95 \$14.95 \$7 \$29.95
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50 00 00 ea <b>00</b> 00 00 00 00 00	Diskettes—10 per b Verbatim— 51/4" SSDD 51/4" DSDD Maxell—51/4" Elephant by Leading Edge Disk head cleaners— VR Data (51/4") Verbatim 51/4" or 8 51/4" plastic library cas Paper & Labels 91/2 x 11 Fanfold— 2700 ct. 141/4 x 11 Fanfold—	\$23.95 \$39.95 \$34.95 \$22.95 \$14.95 " \$29.95 ase 6e \$27.50 \$35.00
50 00 00 ea <b>00</b> 00 00 00 00 00	Diskettes—10 per by Verbatim— 51/4" SSDD 51/4" DSDD Maxell—51/4" Elephant by Leading Edge Disk head cleaners— VR Data (51/4") Verbatim 51/4" or 8 51/4" plastic library case Paper & Labels 91/2 x 11 Fanfold— 2700 ct.	\$23.95 \$39.95 \$34.95 \$22.95 \$14.95 " \$29.95 ase 6e \$27.50 \$35.00
50 00 00 ea <b>00</b> 00 00 00 00 00	Diskettes—10 per by Verbatim— 51/4" SSDD 51/4" DSDD Maxell—51/4" Elephant by Leading Edge Disk head cleaners— VR Data (51/4") Verbatim 51/4" or 8 51/4" plastic library case Paper & Labels 91/2 x 11 Fanfold— 2700 ct. 14/3 x 11/6 labels—5M	\$23.95 \$39.95 \$34.95 \$22.95 \$14.95 " \$29.95 ase 6e \$27.50 \$35.00
50 000 000 eaa <b>000</b> 000 000 000 000 000 000	Diskettes—10 per by Verbatim— 51/4" SSDD 51/4" DSDD Maxell—51/4" Elephant by Leading Edge Disk head cleaners— VR Data (51/4") Verbatim 51/4" or 8 51/4" plastic library cas Paper & Labels 91/2 x 11 Fanfold— 2700 ct. 141/4 x 11 Fanfold— 2700 ct. 31/2 x 11/4, labels—5M Modems	\$23.95 \$39.95 \$34.95 \$22.95 \$14.95 " \$29.95 ase 6e \$27.50 \$35.00
50 000 000 eaa <b>000</b> 000 000 000 000 000 000	Diskettes—10 per b Verbatim— 51/4" SSDD 51/4" DSDD Maxell—51/4" Elephant by Leading Edge Disk head cleaners— VR Data (51/4") Verbatim 51/4" or 8 51/4" plastic library cas Paper & Labels 91/2 x 11 Fanfold— 2700 ct. 141/4 x 11 Fanfold— 2700 ct. 31/2 x 11/4 labels—5M Modems Hayes Smartmodem Micromodem II	\$23.95 \$39.95 \$34.95 \$22.95 \$14.95 \$29.95 ase \$27.50 \$35.00 \$15.00 \$229.00 \$278.00
50 000 000 eaa 000 000 000 000 000 000 00	Diskettes—10 per b Verbatim— 51/4" SSDD 51/4" DSDD Maxell—51/4" Elephant by Leading Edge Disk head cleaners— VR Data (51/4") Verbatim 51/4" or 8 51/4" plastic library cas paper & Labels 91/2 x 11 Fanfold— 2700 ct. 141/4 x 11 Fanfold— 2700 ct. 31/2 x 11/4, labels—5M Modems Hayes Smartmodem	\$23.95 \$39.95 \$34.95 \$22.95 \$14.95 \$29.95 ase \$27.50 \$35.00 \$15.00
50 000 000 eaa 000 000 000 000 000 000 00	Diskettes—10 per b Verbatim— 51/4" SSDD 51/4" DSDD Maxell—51/4" Elephant by Leading Edge Disk head cleaners— VR Data (51/4") Verbatim 51/4" or 8 51/4" plastic library cas Paper & Labels 91/2 x 11 Fanfold— 2700 ct. 141/3 x 11 Fanfold— 2700 ct. 31/2 x 11/4 labels—5M Modems Hayes Smartmodem Micromodem II Micromodem 100 Novation	\$23.95 \$39.95 \$34.95 \$22.95 \$14.95 \$17 \$29.95 ase \$27.50 \$35.00 \$15.00 \$229.00 \$278.00 \$305.00
50 000 000 eaa 000 000 000 000 000 000 00	Diskettes—10 per b Verbatim— 51/4" SSDD 51/4" DSDD Maxell—51/4" Elephant by Leading Edge Disk head cleaners— VR Data (51/4") Verbatim 51/4" or 8 51/4" plastic library cas Paper & Labels 91/2 x 11 Fanfold— 2700 ct. 141/4 x 11 Fanfold— 2700 ct. 31/2 x 11/4 abels—5M Modems Hayes Smartmodem Micromodem II Micromodem 100 Novation Auto cat	\$23.95 \$39.95 \$34.95 \$22.95 \$14.95 \$29.95 ase \$27.50 \$35.00 \$15.00 \$229.00 \$278.00 \$305.00 \$229.00
50 000 000 eaa 000 000 000 000 000 000 00	Diskettes—10 per b Verbatim— 51/4" SSDD 51/4" DSDD Maxell—51/4" Elephant by Leading Edge Disk head cleaners— VR Data (51/4") Verbatim 51/4" or 8 51/4" plastic library cas Paper & Labels 91/2 x 11 Fanfold— 2700 ct. 141/4 x 11 Fanfold— 2700 ct. 31/2 x 11/4, labels—5M Modems Hayes Smartmodem Micromodem II Micromodem 100 Novation Auto cat D Cat	\$23.95 \$39.95 \$34.95 \$22.95 \$14.95 \$29.95 \$27.50 \$35.00 \$15.00 \$278.00 \$305.00 \$229.00 \$278.00 \$305.00 \$165.00
50 000 000 eaa 000 000 000 000 000 000 00	Diskettes—10 per b Verbatim— 51/4" SSDD 51/4" DSDD Maxell—51/4" Elephant by Leading Edge Disk head cleaners— VR Data (51/4") Verbatim 51/4" or 8 51/4" plastic library cas Paper & Labels 91/2 x 11 Fanfold— 2700 ct. 141/4 x 11 Fanfold— 2700 ct. 31/2 x 11/4 abels—5M Modems Hayes Smartmodem Micromodem II Micromodem 100 Novation Auto cat	\$23.95 \$39.95 \$34.95 \$22.95 \$14.95 \$29.95 ase \$27.50 \$35.00 \$15.00 \$229.00 \$278.00 \$305.00 \$165.00 \$155.00

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value in line 410 minus the amount of string space you want to set aside. It is currently set at 32H to give the usual 50 decimal bytes for string storage. Clearxxx in Basic will also work as usual.)

Lines 790-870 test for the control B toggle, which returns normal keyboard operation until you type control B again.

Lines 990-1300 determine whether the key pressed (as returned in register A) is a control, lowercase or uppercase character. I found this particularly interesting as I had not used the carry flag feature of CP (Compare) before. A CP is really a subtract which does not change the registers: If the A register is smaller than the number compared to it, a borrow sets the carry flag on. Then Z means register A was equal to the value compared to; NZ means register A was not equal to the value; C means the value in A was less than the value compared to; and NC means the value in A was equal or greater than that compared to.

Lines 1340-1630, fundamentally the same as Uni-Key, skip through the list of keywords to get to the right one. They count the number of 00 bytes from the start of the words table in line 1730. It is very important that each word (or phrase) be followed by a 00. Several commands include an Enter so one keystroke also executes the command. Examples of these are Run, Auto, and so on. They are shown on the reference chart (Fig. 1) with the symbol <E>. The control J and N keys do not have anything assigned and are available for your additions. If you add words, make sure the end of the last letter in line 2820 does not flow over the start of the Restart routine in line 2870, as only 10 bytes are left. If you need more room, change the ORG in line 320 and the memory protect

# **Using the Program**

If you use the Basic version just CLOAD it right after you turn the computer on and run it immediately. Enter NEW to remove the program and it will work as described below. Watch the auto memory size setting in line 110: If you need a different value, set the memory size when you turn on the computer and delete line 110 or change the values in line 110 before running the program.

If you use the Assembly language version just start your object code loading by Entering System and the name you gave it (mine is KEY) and the program will do the rest. It returns you to the Basic Ready prompt, with Autokey waiting to ease your program typing.

Each key functions as indicated in Fig. 1. For example, if you push the G key you will get a capital G. If you push shift G the word GOTO appears. If you push the shift key, the down arrow key and the G key the word GOSUB will appear. All other keys work

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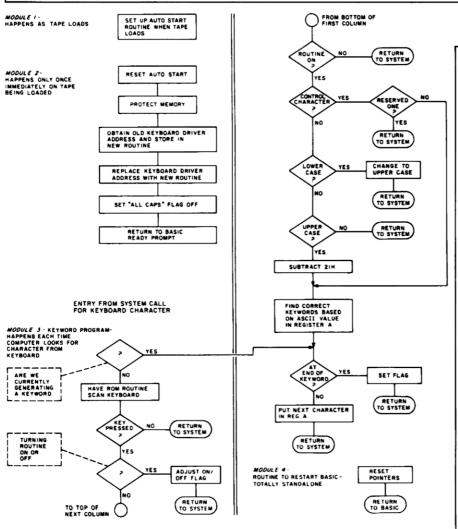
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Key pressed shift down arrow A B C	returned in A register 01	Changed purpose	Pressed			Key		
A B			Shift plus	returned in A register	Changed purpose	pressed	returned in A register	Change: purpose
В		Break	A	41	ASC(	a a	61	A
	92	Toggle	B	42	VAL	b	62	В
-	03	CSAVE"	Č	43	CHRS(	c	63	Č
D	04	Set	D	44	Data	d	64	D
Ē	<b>9</b> 5	Read	Ē	45	Reset	e	65	E
F	<b>Ø</b> 6	FRE(AS)	F	46	For	f	66	F
G	97	GOSUB	G	47	GOTO	9	67	G
Н	<b>0</b> 8	Reser	н	48	Return	h	68	н
1	<b>Ø</b> 9	INKEY\$	1	49	Input	i	69	1
J	ØA	avail	J	4A	)	j	6A	J
K	<b>0</b> B	LLIST	K	4B	LEN(	k	6B	K
L	<b>0</b> C	List	L	4C	LPRINT	1	6C	L
М	<b>O</b> D	Reser	м	4D	MID\$(	m	6D	М
N	0E	avail	N	4E	Next	n	6E	N
0	<b>9</b> F	POKE	0	4F	PEEK(	0	6F	0
Р	10	Point	P	50	PRINT@	P	70	P
Q	11	LEFT\$(	Q	51	RIGHT\$	q	71	Q
R	12	Run	R	52	RND(	r	72	R
S	13	SQR(	S	53	STRING\$	S	73	s
Т	14	TAB(	T	54	Then	t	74	т
U	15	USR(9)	U	55	Using	u	75	U
V	16	CLS	V	56	VARPTR(	v	76	V
W	17	Edit	W	57	Else	w	77	w
X	18	Reser	X	58	CLOAD	×	78	×
Y	19	TROFF	Y	59	TRON	у	79	Y
Z	1 <b>A</b>	Auto	Z	5A	User String	z	7 <b>A</b>	Z
†	1B	Reser		Subtract Subtract				
,	1C	/32755		21H from			20 H	
9	1D	avail		each to			eac	h to
	1E	System		fit after cha				ge to
1	1F	? MEM					uppe	case
	₹							



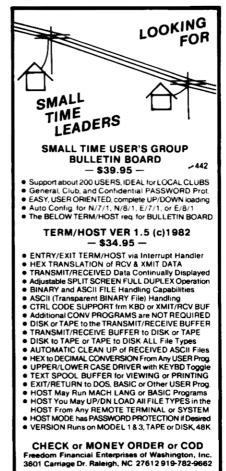


Figure 4





# **STARFIGHTER**

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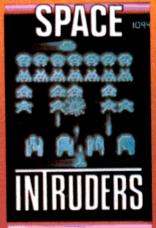
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a vengeance and Adventure Interna-tional has 'em! SPACE INTRUDERS has been praised by major microcomputing publications from 80-U.S. to Creative Computing as "fantastic," "excellent," "top of the line," and, well, you get the idea! SPACE INTRUDERS faithfully reproduces the hit Deluxe arcade machine in all of its frustratingly enjoyable glory. An absolute must for any serious game collection!
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# "This 13-byte routine has saved me hundreds of hours..."

similarly.

To return to the normal keyboard push shift, down arrow, and B. You can now type lower and uppercase letters or use the standard shift 0 feature to lock in all caps. Pushing shift, down arrow, B again will restore the keyword mode. If you used shift 0 you must toggle it off.

# **User Definable String**

You can program an alphanumeric string of your choice (up to 68 characters) at any time and insert it into your program.

To use this feature type in a line 0 jump-

ing to the first line in your program (for example, 0 GOTO 10). Type in a line 1 setting a variable named Z\$ equal to your desired string (for example, 1 Z\$ = "This Is My Desired String"). Push shift Z; a preprogrammed line 2 will appear. Enter RUN1. From now on, whenever you push shift Z, your selected string will appear in your program.

If you leave this little routine in place until you are finished you can change your string at any time by putting a new string in line 1 Z\$ = "..." and typing RUN1. Before saving the final version of your program, type Delete 0-2 and you will not have these as a

permanent appendage. (Of course, you cannot use lines 0-2 or Z\$ in your own programs.)

# **Restore Basic Pointers Routine**

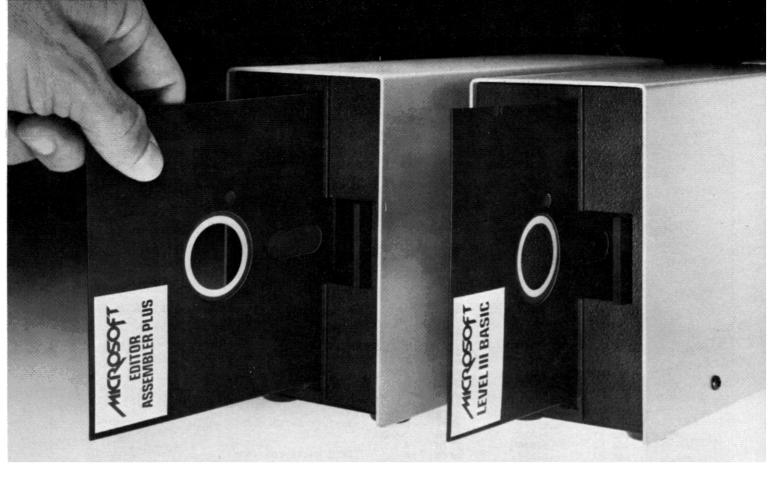
This 13-byte routine has saved me hundreds of hours retyping because I typed CLOAD when I meant CSAVE, or when new USR routines locked up the computer.

When you issue the CLOAD command the computer first resets all the Basic pointers, ready to put the new program in the right memory locations. But unless you actually read in some new code, the old pro-

```
Program Listing 1
               00100 ;**
               00110 ;*
               00120 ;*
                                           AUTO -
                                                        KEY
               00130 ;*
                                             JULY
                                                      1981
               00140 ;*
               00150 ;*
                                A Program to Produce BASIC KEYWORDS
               00160 ;*
                                With a Single Keystroke-TRS80-MODIII
               00170 ;*
               00180 ;*
                                                 Don Rigg
               00190
                                           17 Bittersweet Bay
               00200
                                        Winnipeg, Manitoba, Canada
Tel (204)253-9230
               00210
                     ; *
               00220
                     ,****
               00230
               00240
               00250 ;
                       ***
                              Set Up Auto Start
                                                    ***
               00260 ;
               00270
41E2
                              ORG
                                       41E2H
                                                ;SYSTEM Jump Address
41E2 C3E07D
               00280
                                       START
                                                ; AUTOKEY Initialization Rtn.
               00290 ;
               00300;
                              Initialization Routines
               00310 ;
7DEØ
               00320
                              ORG
                                       7DEØH
               00330 ;
               00340 ;
                              RESET AUTO START
               00350 ;
               00360 START
7DEØ 3EC9
                              LD
                                       A,ØC9H
                                                        ;RET Code
7DE2 32E241
               00370
                              LD
                                       (41E2H),A
                                                        ; To SYSTEM RAM
               00380 ;
               00390 ;
                              SET MEMORY PROTECT
               99499
7DE5 21DE7D
                                       HL,7DDEH
               00410
                              LD
                                                         ;7DEØH-2
                                                         ; Put in 'END OF BASIC' Ptr
               00420
7DE8 22B140
                              LD
                                       (40BlH),HL
7DEB 21AC7D
               00430
                              LD
                                       HL,7DACH
                                                         ;Mem Size-32H (50D)
7DEE 22A040
               00440
                              LD
                                       (40A0H),HL
                                                         ; Put in 'START OF STRING SPA
CE' Ptr
7DF1 CD721B
                                                         ;Reset ALL Pointers
               00450
                              CALL
                                       1B72H
               00460
               00470
                              REPLACE KEYBOARD DRIVER ADDRESS
               00480 ;
7DF4 2A1640
               00490
                              LD
                                       HL, (4016H)
                                                         ;Obtain OLD KBD Driver Addre
7DF7 220F7E
               00500
                                       (GETCHR+1), HL
                               LD
                                                         ; Put in CALL Statement
7DFA 21087E
               00510
                               LD
                                       HL, NEWDVR
                                                         ; Put New Driver
7DFD 221640
               00520
                                       (4016H),HL
                              LD
                                                         ;Address in KBD DCB
               00530
               00540 ;
                              SET ALL CAPS OFF
               00550 ;
7E00 3E00
               00560
                               LD
                                                         ; 0 = Off
7E02 321940
               00570
                               LD
                                       (4019H),A
                                                         ; All CAPS Flag
               00580 ;
               00590
                               RETURN TO BASIC READY PROMPT
               00600 ;
7EØ5 C3191A
                                       1A19H
               00610
                               JР
               00620 ;
               00630 ;
                               Main AUTOKEY Program
               00640
               00650 ;
                               ENTRY FROM ROM CALL TO SCAN KEYBOARD
                                                                                  Listing 1 continues
```

```
Listina 1 continued
                              00660 ;
00670 NEWDVR
             7EØ8 3A7E7E
                                                       A, (SUBFLG)
                                                                          ; If flag >< 0 in middle
                                             LD
                                                                          of a KEYWORD
                              98689
             7EØB B7
                                              OR
                                                                          ;Substitution-CONTINUE
             7EØC 205E
                                                       NZ, CONTI
                              00690
                                              JR
                              00700 ;
                              00710 ;
                                              Get Character
                              00720 ;
00730 GETCHR
             7E8E CD8888
                                              CALL
                                                       s-s
                                                                 ;Original Keyboard Scan Rtn.
             7E11 B7
                              88748
                                              OR
                                                                 ;Character Returned in A
                                                                 ; No Key Pressed-Process Ordinarily
             7E12 C8
                              00750
                                              RET
                              00760 ;
                                              TEST FOR SWITCH CHANGE
                              00770 ;
                              00780 ;
             7E13 F5
                              00790
                                              PUSH
                                                                 ; Save Kbd Char
                                                       02H ;CNTRL B Toggle
NZ,SWTST ; Don't Change
A,(ONOFF) ;Get Status Switch
              7E14 FE02
                              99899
                                              CP
             7E16 200C
7E18 3A7D7E
                              00810
                                              JR
                              00820
                                              LD
              7E1B C680
                              00830
                                              ADD
                                                        A,80H
                                                                Results in 00 or 80
              7E1D 327D7E
                              00840
                                              LD
                                                        (ONOFF), A ; Update
              7E20 F1
                              00850
                                              POP
                                                        AF
                                                                 Restore Original Character
              7E21 3E00
                              00860
                                              LD
                                                        A,ØH
                                                                 ; Change to NULL=No Key Pressed
              7E23 C9
                              00870
                                              RET
                                                                 ;Back to ROM Routine
                              00880 ;
                              00890 ;
                                              TEST IF RTN ON or OFF
                              00900;
             7E24 3A7D7E
7E27 FE00
                                                        A, (ONOFF) ; Get Status
ØH ; Rtn ON
                              00910 SWTST
                                              T.D
                              00920
                                              CP
                                                        Z,CTRTST;Continue This Routine
AF ;Get Original Character
              7E29 28#2
                              00930
                                               JR
              7E2B F1
                              66946
                                               POP
                                                                  ;Routine OFF-Process Ordinarily
              7E2C C9
                              00950
                                               RET
                              00960
                              00970
                                               TEST FOR CONTROL CHAR
                              00980
              7E2D F1
7E2E FE20
                              00990 CTRTST
                                                        AF
                                              POP
                                                                 ;Get Character Pressed
                                                        20H ; Key < Spacebar C, CNTRL ; Must be CONTROL CHAR
                              01000
                                               CP
              7E30 3802
7E32 1811
                                               JR
                              01010
                                                        LWRTST ; Not CONTROL Test for Lower Case
                              01020
                                               JR
                              01030 CNTRL
              7E34 FE08
                                               CP
                                                        ЯH
                                                                  ;Skip Selected Characters-Backspace
              7E36 C8
                              01040
                                               RET
                                                        Z
                                                                 ; Process Ordinarily
              7E37 FE01
7E39 C8
                              01050
                                               CP
                                                        1H
                                                                 Break
                              01060
                                               RET
                                                                  Process Ordinarily
              7E3A FEØD
                              01070
                                               CP
                                                        ØDH
                                                                  ;Enter
              7E3C C8
                              01080
                                               RET
                                                                  Process Ordinarily
              7E3D FE1B
                              01090
                                               CP
                                                        1BH
                                                                  ;Shifted UP Arrow
              7E3F C8
                              01100
                                               RET
                                                                  ; Process Ordinarily
              7E40 FE18
                              01110
                                                        18H
                                                                  ;Shifted LEFT Arrow
                                               CP
              7E42 C8
                              01120
                                               RET
                                                                  Process Ordinarily
              7E43 1812
                              01130
                                               JR
                                                        FINDST
                                                                 ;Find String for Remaining CONTROL C
              hars.
                              01140 ;
                              01150 ;
                                               TEST FOR lower case
                              01160
              7E45 PE61
                              01170 LWRTST
                                               CP
                                                        61H
                                                                  ; =a
                                                        C, UPTST ; Below Lower Case-See If UPPER Case
              7E47 3806
                              01180
                                               JR
              7E49 FE7B
7E4B DØ
                              Ø119Ø
                                                        7BH
                                                                  ;>z
                                               CP
                               01200
                                               RET
                                                                  ;TOO High
                                                        NC
                              01210
              7E4C D620
                                               SUB
                                                        20H
                                                                  ;Must be a Lower Case
              7EAR CO
                              01220
                                               RET
                                                                  ;Change & Process as UPPER Case
                               01230 ;
                               01240 ;
                                               TEST FOR UPPER CASE
                               01250 ;
              784F FE41
                               #126# UPTST
                                               CP
                                                         41 H
                                                                  ;=A
              7E51 D8
                               Ø127Ø
                                               RET
                                                         С
                                                                  ;Too Low-Between Spacebar & @
              7E52 FE5B
                               01280
                                                         5BH
                                               CP
                                                                  ;>2
              7E54 DØ
                               01290
                                               RET
                                                                  ;Too High Between Up Arrow & -
                                                         NC
              7E55 D621
                               01300
                                                         21H
                                               SUB
                                                                  ;Follow after Controls
                               01310
                               01320 ;
                                               FIND LOCATION IN TABLE
                               01330
                               01340 FINDST
              7E57 E5
                                               PUSH
                                                                  ;Save Original
                                                         HL.
              7E58 21817E
                               01350
                                               LD
                                                         HL, WORDS ; Start of KEYWORD Table
              7E5B 47
7E5C 7E
                                                                  ;Save Number of KEYWORDS to Skip
;Look @ BYTE in Table
                                                        B,A
                               01360
                                               LD
                                                         A, (HL)
                               01370 NOTON
                                               L.D
              7E5D 23
                               Ø138Ø
                                               INC
                                                         HL
                                                                  ;Get Ready for Next
              7E5E B7
                               01390
                                               OR
              7E5F 20FB
7E61 10F9
                               01400
                                                         NZ, NOTON ; Not End of KEYWORD
                                               JR
                               01410
                                               DJNZ
                                                                 ;Count Number of KEYWORDS
                                                         NOTON
                               01420 ;
                               01430 ;
                                               SEARCH FINISHED - STORE LOCATION
                               01440 ;
              7E63 227F7E
                                                         (STRPTR), HL ; Save Pointer to String Wanted
                               01450
                                               I.D
              7E66 3E01
7E68 327E7E
                                                         A,1 ;Set Flag to (SUBFLG),A ;Indicate Substitution
                               01460
                                               LD
                                                         A,1
                               01470
                                               \mathbf{L}\mathbf{D}
              7E6B E1
                               01480
                                               POP
                                                         HT.
                                                                  ;Restore Original
                               01490
                               01500 ;
                                               ONE CHARACTER TO SCREEN
```

Listing 1 continues



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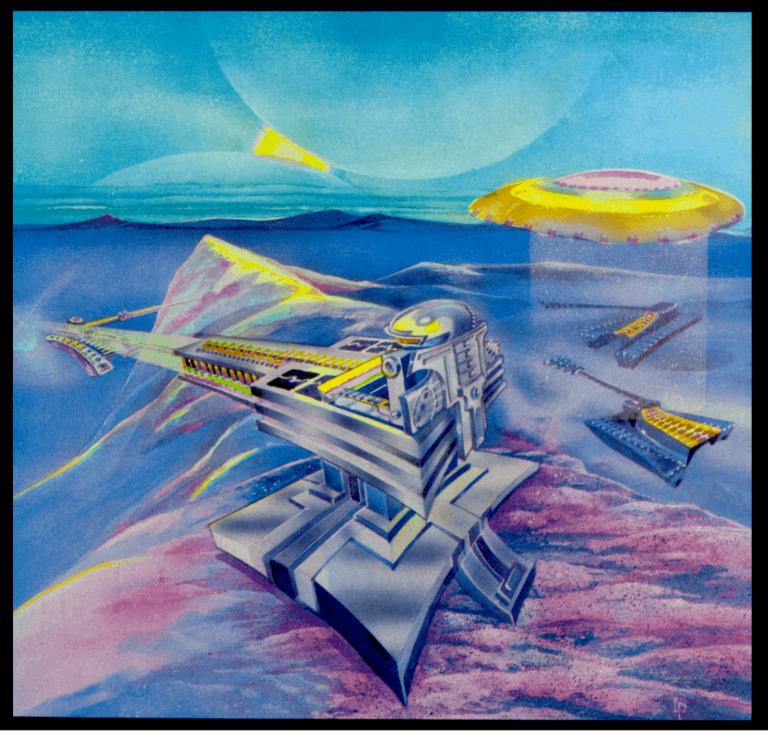
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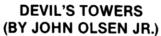
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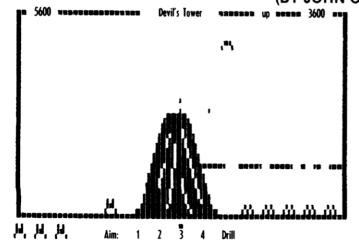
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```
Listing 1 continued
                                           ALSO BRANCH FROM ENTRY
                            01510;
                            01520
                                           POINT IF CONTINUING
                                  ;
             7E6C E5
                            01540 CONTI
                                           PUSH
                                                             ;Save Original
                                                    HL,(STRPTR) ;Get Addr of Char to Process A,(HL) ;Put in 'A'
             7E6D 2A7F7E
                            01550
                                           LD
             7E70 7E
                            01560
                                           LD
                                                    A, (HL)
             7E71 B7
                            01570
                                           OR
                                                             ;See if Zero
             7E72 2003
                            01580
                                           JR
                                                    NZ, MORE ; Continue if not Last
             7E74 327E7E
                            Ø159#
                                           LD
                                                    (SUBFLG), A ; Set Flag to Stop Process
                                                             ;Point to Next Character
             7E77 23
                            01600 MORE
                                           INC
             7E78 227F7E
                                                    (STRPTR), HL ; Save Address
                                           T.D
                            01610
                            01620
                                           POP
             7878 E1
                                                    HT.
                                                             ;Restore Original
             7E7C C9
                            01630
                                           RET
                                                             ;Output Character
                            01640
                            Ø165Ø
                                           SWITCHES/FLAGS
                            01660
             7E7D 88
                            01670 ONOFF
                                           DEFR
                                                             ;FLAG-If Routine ON (00) or OFF (80H
             7E7E 00
                            01680 SUBFLG
                                           DEFB
                                                             ;FLAG-If Currently Substituting(00)
             or Not (01)
             7E7F 0000
                            01690 STRPTR
                                           DEFW
                                                    Ø
                                                             ; Address of Char TO BE Substituted
                            01700
                            01710
                                           REPLACEMENT WORDS
                            01720
             7E81 0000
                            01730 WORDS
                                           DEFW
                                                    00
                                                             ;Skip Null(00H), CONTROL A <Break> (0
             1H),
7E83 00
                            01740
                                           DEFB
                                                             ; and CONTROL B <On/Off Toggle> (#2H)
             7E84 43
                                           DEFM
                                                    'CSAVE"'
             7E8A 00
                            01760
                                           DEFB
             7E8B 53
                            01770
                                           DEFM
                                                    'SET('
             7E8F 66
                            Ø178Ø
                                           DEFB
             7E90 52
                            01790
                                           DEFM
                                                    'READ'
             7E94 00
                            01800
                                           DEFB
             7E95 3F
                            Ø181Ø
                                           DEFM
                                                    '?FRE(A$)'
                                                    7E9D ØD00
                            01820
                                           DEFW
             7E9F 47
                            01830
                                           DEFM
             7EA4 00
                            01840
                                           DEFB
                                                    7EA5 00
                            Ø185Ø
                                           DEFB
             7EA6
                  49
                            Ø186Ø
                                           DEFM
             7EAC 00
                            Ø187Ø
                                           DEFB
                            01880 ;
                                         CONTROL
                                                  J
                                                    Available
             7EAD 00
                            Ø189Ø
                                           DEFB
             7EAE
                  4C
                            01900
                                           DEFM
                                                    'LLIST'
             7EB3 00
                            01910
                                           DEFB
             7EB4
                  4C
                            Ø192Ø
                                           DEFM
                                                    'LIST'
             7EB8
                            Ø193Ø
                                           DEFB
                            01940
             7EB9
                  00
                                           DEFB
                                                             ;Skip Enter <0DH>
                                                    а
                             01950 ;
                                        CONTROL N Available
             7EBA 00
                             01960
                                           DEFB
             7EBB 50
                             01970
                                                     POKE
                                           DEFM
             7EBF 00
                             01980
                                            DEFB
                                                    'POINT('
             7ECØ 50
                             01990
                                           DEFM
             7EC6 00
                             82000
                                           DEFB
             7EC7
                  4C
                            02010
                                           DEFM
                                                    'LEFT$('
             7ECD 88
                            02020
                                            DEFB
             7ECE 52
                            02030
                                           DEFM
                                                    RUN
             7ED1 0000
                                           DEFW
                                                    ØØØDH
                            02040
                                                    'SQR('
             7ED3
                  53
                             02050
                                           DEFM
             7ED7
                  00
                             02060
                                            DEFB
                                                    'TAB('
                                           DEFM
             7ED8 54
                             02070
                  00
                                            DEFR
             7EDC
                             02086
                                                     'USR(0)'
             7EDD 55
                            02090
                                           DEFM
             7EE3 00
                             02100
                                            DEFB
                                                     'CLS'
             7EE4
                   43
                             02110
                                            DEFM
             7EE7
                  00
                             02120
                                            DEFB
                                                     'EDIT'
             7EE8
                  45
                             02130
                                            DEFM
             7EEC 00
                             02140
                                            DEFB
             7EED 00
                             02150
                                            DEFB
                                                             ;Skip Shift LEFT Arrow <18H>
                                                     'TROFF'
             7EEE 54
                             02160
                                            DEFM
             7EF3 00
                             02170
                                            DEFB
                                                     'AUTO'
              7EF4 41
                             02180
                                            DEFM
              7EF8 ØDØØ
                             02190
                                            DEFW
                                                     ØØØDH
                                                     7EFA 00
                             02200
                                            DEFB
              7EFB 2F
                             02210
                                            DEFM
              7F01 00
                             02220
                                            DEFB
                             Ø223Ø
                                        CONTROL
                                                 9 Available
              7FØ2 88
                             02240
                                            DEFB
              7FØ3 53
                                                     'SYSTEM'
                             02250
                                            DEFM
              7FØ9 ØØ
                             Ø226Ø
                                            DEFB
              7PØA 3F
                             02270
                                            DEFM
                                                     '?MEM'
              7F0E 0D00
                                            DEFW
                                                     000DH
                             02280
             7F10 41
7F14 00
                                                     'ASC('
                             02290
                                            DEFM
                             02300
                                            DEFB
                             02310
                                                     'VAL('
             7F15 56
7F19 00
                                            DEFM
                             02320
                                            DEFB
                                                     'CHR$('
              7F1A 43
                             02330
                                            DEFM
                                                                                            Listing 1 continues
```







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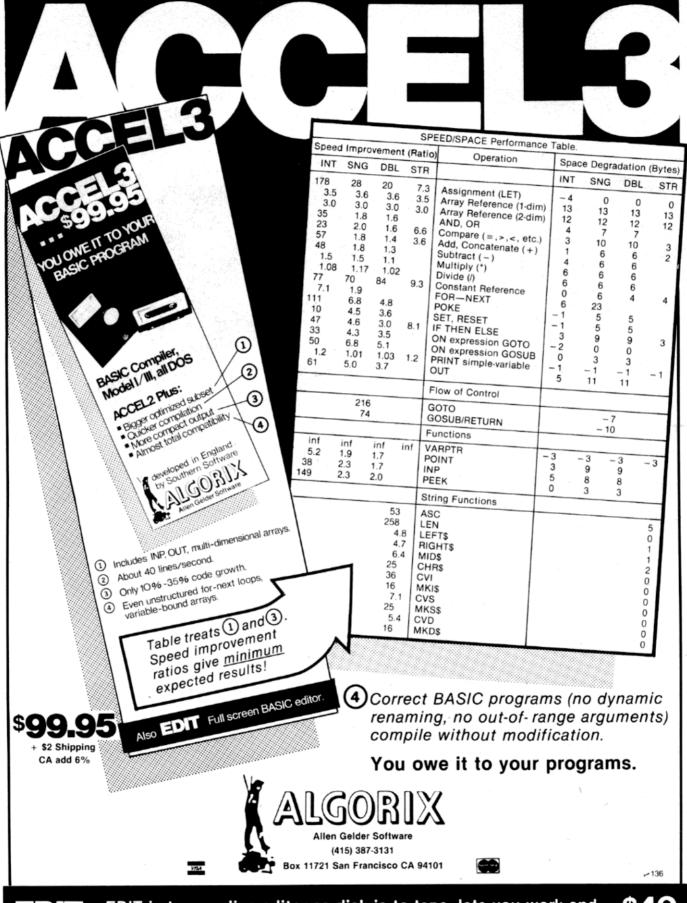
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gram is still intact—you just cannot get at it.

I keep this routine in protected high memory; putting it on the end of Autokey has worked out very well. I incorporated the system jump address into Autokey making it quite easy to run it.

When you want to use it put the Autokey program in keyword mode. Press shift, down arrow, period and System will appear. Press Enter and the System prompt \*? will

appear. Press shift, down arrow, comma and the routine's entry address in decimal will appear (/32755). Press Enter. The routine will execute and return you to the Basic Ready prompt ready to run, list, or CSAVE your program. Then you can continue as if nothing had happened. Remember, do not turn off the computer, or all is lost. (J. Kovacic developed the code for this routine; it was published in Interface Age some time ago.)

You can have your own machine language copy of this program by assembling the source code listing. You can also enter the hex instructions on the left of the listing with a monitor. (The Z-Bug program in the January 1981 issue of 80 Microcomputing, one of the better ones around, works well on the Model III.) You can also use the Basic program listed, or, if all this seems too much I will give you a free high baud copy of source and object code. Just send me a

```
Listing 1 continued
             7F1F 00
                             02340
                                             DEFB
             7F28 44
                             02350
                                                      'DATA'
                                             DEFM
             7F24 00
                             02360
                                             DEFE
             7F25 52
                             Ø237Ø
                                                       'RESET('
                                             DEPM
             7F2B 00
                             02380
                                             DEFR
                                                       'FOR'
             7F2C 46
                             02390
                                             DEFM
             7F2F 00
                             62466
                                             DEFB
             7F3Ø 47
                             02410
02420
                                                       COTO
                                             DEFM
             7F34 ØØ
                                             DEFB
             7F35 52
                             02430
                                                       RETURN
                                             DEFM
             7F3B 00
                             02440
02450
                                             DEFR
                                                       INPUT"
             7F3C 49
                                             DEFM
             7F42 00
                             02460
                                             DEFR
             7F43 29
                             02470
                                             DEFM
             7P44 00
                             02480
                                             DEFB
                                                       'LEN('
             7F45 4C
                             02490
                                             DEFM
             7F49 ØØ
                             02500
                                             DEFB
             7F4A 4C
                             02510
                                             DEFM
                                                       LPRINT
              7F50 00
                              02520
                                             DEFB
              7F51 4D
                              02530
                                                       'MID$('
                                             DEFM
              7F56 ØØ
                              Ø254Ø
                                             DEFB
              7F57 4E
                              02550
                                                       'NEXT'
                                             DEFM
              7F5B 00
                              02560
                                             DEFB
              7F5C 5Ø
                              02570
                                             DEFM
                                                       'PEEK('
              7F61 00
                              02580
                                             DEFB
              7F62 50
                              02590
                                                       'PRINT@'
                                             DEFM
              7F68 ØØ
                              02600
                                              DEFE
              7F69 52
                                                       'RIGHTS('
                              Ø261Ø
                                             DEFM
              7F70 00
                              02620
                                              DEFB
              7F71 52
                              02630
                                             DEFM
                                                       'RND('
              7F75 00
                              02640
                                             DEFB
                                                       'STRINGS('
              7F76 53
                                             DEFM
                              02650
              7F7E 00
                              02660
                                             DEFR
                                                       THEN
              7F7F 54
                              02670
                                             DEFM
              7F83 ØØ
                              Ø268Ø
                                              DEFB
                                                       USING
              7F84 55
                              02690
                                              DEFM
              7F89 00
                              02700
                                              DEFR
                                                        VARPTR('
              7F8A 56
                              02710
                                              DEFM
              7F91 00
                              02720
                                              DEFR
              7F92 45
                              Ø273Ø
                                              DEFM
                                                       'ELSE'
              7F96 ØØ
                              02740
                                              DEFB
                                                       'CLOAD'
              7F97 43
                              Ø275Ø
                                              DEFM
              7F9C 00
                              02760
                                              DEFB
              7F9D 54
                                              DEFM
                                                       'TRON'
              7FA1 00
                              02780
                                              DEFB
                                                       '2FORI=1TOLEN(Z$):POKEI+32673'
              7FA2 32
                              Ø 27 9Ø
                                              DEFM
                              02800
                                              DEFM
              7FBE 2C
                                                        ,ASC(MID$(Z$,I,1))'
                   3A
                                                        : NEXT: POKEI+32673, 0: END'
              7FDØ
                              Ø281Ø
                                              DEFM
              7FE7 0D00
                                                                ; End of Last Substitution String
                              02820
                                              DEFW
                                                       000DH
                              02830
                              Ø284Ø
                                              ROUTINE TO RESTART BASIC
                              02850
              7FF3
                                              ORG
                                                       7FF3H
                              02860
                                                                :32755D
              7FF3 2AA440
                              92879
                                              LD
                                                       HL, (40A4H)
                                                                         ;Find Start of Text Storage
              Area
                              Ø288Ø
                                              LD
              7FF6 74
                                                       (HL),H
                                                                         ; Put Something Non-zero into
               PTR
              7FF7 CDF81A
                              02890
                                              CALL
                                                       1AF8H
                                                                          ; Adjust All PTRS
              7FFA CD591B
                              02900
                                              CALL
                                                       1B59H
                                                                         ;Fix(40F9H),(40FAH),perform
              CLEAR
              7FFD C3191A
                              02910
                                              JΡ
                                                       1A19H
                                                                         ; To READY Prompt
                                              END
              0000
                              02920
              00000 TOTAL ERRORS
```

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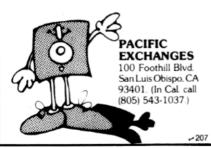
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tape with one of your favorite programs on it and I will return it with Autokey. (Don't forget some instructions!)

#### **Modifications**

As with any program, just when you finish, you think of many things to add and change. I am planning to change the check for 00H bytes at the end of each keyword to check for a high order bit in the last character of the keyword instead. I'll use the space taken up by the zeroes to add Auto Edit from the February 1981 issue of 80 Microcomputing. I would be very happy to hear

from you if you enhance this program—just drop me a line.

I sequenced the initialization code at the beginning of the program to make it easy to restart if you reset the computer and end up back at the CASS? prompt. Push Enter twice, Enter System, then /32224, and it will start up again.

You can also set another protected memory size in answer to the memory size question and retain it by entering System and /32244 to skip the auto memory size routine.

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### Program Listing 2

```
10 REM
20 REM
                        AUTO-KEY
                                                 ••
                **
30 REM
                           Don Rigg
July,1981
                **
                                                 **
40 REM
                                                 **
50 REM
60 REM
70 REM
80 CLS: PRINT@524, CHR$(23) "AUTOKEY NOW LOADING"
90 REM *** Protect Memory From 32224 (7DE0H) On ***
100 POKE16561,222: POKE16562,125: CLEAR 50
110 DEFINT B: DEFDBL C
120 REM *** Read AUTOKEY Object Code ***
130 FOR A% = 32224 TO 32387:
                                             REM 7DEØH TO 7E83H
         READ B
140
         POKE A%,B
150
160
         C=C+B
170 NEXT
180 IF C <> 17956 THEN PRINT "Error in Data Stmts 610 to 710":
   END
190 REM
200 C=0
            *** Read RESTORE BASIC Object Code ***
210 FOR A = 32755 TO 32767:
                                            REM 7FF3H TO 7FFFH
          READ B
 220
          POKE A,B
230
 240
          C=C+B
 250 NEXT
260 IF C <> 1432 THEN PRINT "Error in Data Stmt 730":END
             *** Read KEYWORDS ***
 270 REM
 280 C=0
                                          REM 7E84H TO 7FF2H
 290 FOR A% = 32388 TO 32754:
          READ B$
          B = ASC(B\$)
 310
                                            REM Change & to ENTER REM Change Ø to NULL
 320
          IF B = 38 THEN B = 13:
          IF B = 48 THEN B = 0:
 330
                                            REM Change ' to
          IF B = 39 THEN B = 34:
 340
                                            REM Change ! to 0
 350
          IF B = 33 THEN B = 48:
          POKE A%, B
 360
 370
          C=C+B
 380 NEXT
 390 IF C <> 20500 THEN PRINT "Keywords different from Original L
             Program Continuing"
 ist
 400 REM *** Execute Object Code ***
410 POKE 16526,224:POKE16527,125:
                                                   REM 7DEØ
 420 CLS
 430 A = USR(0)

440 REM *** Data For AUTOKEY Object Code ***

450 DATA 62,201,50,226,65,33,222,125,34,177,64,33,172,125,34,160
 468 DATA 64,285,114,27,42,22,64,34,15,126,33,8,126,34,22,64
478 DATA 62,0,58,25,64,195,25,26,58,126,126,183,32,94,285,36
488 DATA 48,183,288,245,254,2,32,12,58,125,126,198,128,58,125
 490 DATA 126,241,62,8,201,58,125,126,254,0,40,2,241,201,241
500 DATA 254,32,56,2,24,17,254,8,200,254,1,200,254,13,200,254
510 DATA 27,200,254,24,200,24,18,254,97,56,6,254,123,208,214
 520 DATA 32,201,254,65,216,254,91,208,214,33,229,33,129,126
530 DATA 71,126,35,183,32,251,16,249,34,127,126,62,1,50,126
  540 DATA 126,225,229,42,127,126,126,183,32,3,50,126,126,35,34
                                                                           Listing 2 continues
```

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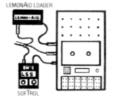
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Listing 2 continued

```
550 DATA 127,126,225,201,0,0,211,126,0,0,0
560 REM *** Data For RESTORE BASIC Object Code ***
560 REM
570 DATA 42,164,64,116,205,248,26,205,89,27,195,25,26
580 REM *** Data For KEYWORDS ***
590 DATA C,S,A,V,E,',0
600 DATA S,E,T,(,0
610 DATA R,E,A,D,0
620 DATA ?,F,R,E,(,A,$,),&,0
630 DATA G,O,S,U,B,0,0
640 DATA I,N,K,E,Y,$,0,0
650 DATA L,L,I,S,T,0
660 DATA L,I,S,T,0,0,0
670 DATA P,O,K,E,0
680 DATA P,O,I,N,T,(,0
690 DATA L,E,F,T,$,(,0
700 DATA R,U,N,&,0
710 DATA S,Q,R,(,0
720 DATA T,A,B,(,0
730 DATA U,S,R,(,2,),0
740 DATA C,L,S,0
750 DATA E,D,I,T,0,0
760 DATA T,R,O,F,F,0
770 DATA A,U,T,O,&,0,0
780 DATA /,3,2,7,5,5,0,0
790 DATA S,Y,S,T,E,M,0
800 DATA ?,M,E,M,&,0
810 DATA A,S,C,(,0
820 DATA V,A,L,(,0
830 DATA C,H,R,$,(,0
840 DATA D,A,T,A,0
850 DATA R,E,S,E,T,(,0
860 DATA F,O,R,0
870 DATA G,O,T,O,0
880 DATA R.E.T.U.R.N.0
890 DATA I,N,P,U,T,',0
900 DATA ),0
910 DATA L,E,N,(,0
920 DATA L,P,R,I,N,T,0
930 DATA M,I,D,$,(,0
940 DATA N,E,X,T,0
950 DATA P,E,E,K,(,0
960 DATA P,R,I,N,T,0,0
970 DATA R,I,G,H,T,$,(,0
980 DATA R,N,D,(,0
990 DATA S,T,R,I,N,G,$,(,0
1000 DATA T,H,E,N,0
1010 DATA U,S,I,N,G,0
1020 DATA V,A,R,P,T,R,(,0
1030 DATA E,L,S,E,0
1040 DATA C,L,O,A,D,0
1050 DATA T,R,O,N,0
1060 DATA 2,F,O,R,I,=,1,T,O,L,E,N,(,Z,$,),":",P,O,K,E,I,+
1070 DATA 3,2,6,7,3,",",A,S,C,(,M,I,D,$,(,Z,$,",",I,",",1,),)
1080 DATA ":",N,E,X,T,":",P,O,K,E,I,+,3,2,6,7,3,",",1,":"
1090 DATA E,N,D,&,0,0,0,0,0,0,0,0,0,0,0,0
```

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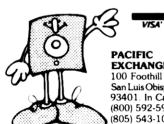
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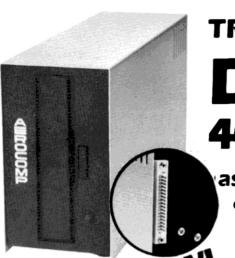
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for Basic interpreter functions. The map also covers the memory mapped input/output from 37DEH-37FFH used to communicate with the keyboard, the printer, disk drives, and the real-time clock.

This map is a general guide to Level II ROM routines, not a complete reference source. Use this map with a disassembled listing of the Level II ROMs.

Write to me if you wish more detail in areas of this memory map.

■

### Level II Memory Map

```
INITIALIZATION ROUTINE
            TURNS OFF DISK AND CLOCK INTERRUPTS
            ZERO A
JUMP TO INITIALIZATION ROUTINE AT 0674
**********
            **********************************
0005 - 0007 JUMP TO RET OB CODE AT 1096 VIA 4000
            JUMP TO RST OB CODE AT 1096 VIA 4000
0008 - 000A
000B - 000C
            DISK ROUTINE
            GET JUMP ADDRESS
000B
            JUMP TO SPECIFIED ADDRESS
**********
            *************************************
000D - 000F
            JUMP TO DISK LOADER ROUTINE
0010 - 0012
0010 - 0012
            JUMP TO RST 10 CODE AT 1078 VIA 4003
```

```
KEYBOARD ROUTINE
0013 SAVE BC

0014 - 0015 B = KEYBOARD ENTRY CODE

0016 - 0017 JUMP TO DRIVER ENTRY ROUTINE
0014 - 0015
0016 - 0017
0018 - 001A JUMP TO RST 18 CODE AT 1090 VIA 4006
0018 - 0014
001B - 001F
              VIDEO ROUTINE
001B
001C - 001D
001E - 001F
              B = VIDEO ENTRY CODE
JUMP TO DRIVER ENTRY ROUTINE
            ***********************************
0020 - 0022
              JUMP TO RST 20 CODE AT 2509 VIA 4009
DISK ROUTINE
              SAVE BC
B = ENTRY CODE
0023
0024 - 0025
0026 - 0027
              JUMP TO DRIVER ENTRY ROUTINE
             **********
0028 - 002A
             RET WITH NON DISK VIA 400C
0028 - 002A
002B - 002F
              DE = KEYBOARD DRIVER ADDRESS
              JUMP TO KEYBOARD DRIVER
             #SCANS KEYBOARD AND RETURNS WITH BYTE IN A
0030 - 0032
0030 - 0032
              RET WITH NON DISK VIA 400F
0033 - 0037
              VIDEO ROUTINE
              DE = VIDEO DRIVER ADDRESS
JUMP TO VIDEO DRIVER
#DISPLAY THE BYTE IN A
0033 - 0035
0038 - 003A
              RET WITH NON DISK VIA 4012
              PRINTER ROUTINE
003B - 003D
              DE = PRINTER DRIVER ADDRESS
                                              Map continues
```

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Map continued	
003E - 003F JUMP TO PRINTER DRIVER	0140 - 0141 CHECK FOR > 127
#PRINT THE BYTE IN A	0140 - 0141 CHECK FOR > 127 0142 - 0144 IF > THEN FC ERROR
0040 - 0042 INPUT ROUTINE	0145 SAVE X VALUE 0146 - 0147 CHECK SYNTAX
0040 - 0042 JUMP TO INPUT ROUTINE AT 05D9	0148 - 014A A = Y VALUE
0043 RETURN	014B - 014C CHECK FOR > 47 014D - 014F
111111111111111111111111111111111111111	0150 - 017F COMPUTE VIDEO LOCATION AND BIT MASK 0180 - 0181
0044 - 0045 NOTHING HERE	0182 RESTORE GRAPHIC CHARACTER
0046 - 0048 JUMF TO DRIVER ENTRY ROUTINE	0183 - 0185 IF SET THEN JUMP 0186 - 0188 RESET BIT
0049 - 004F KEYBOARD ROUTINE	01BC - 01BD CHECK SYNTAX 01BE RETURN
0049 - 004B SCAN KEYBOARD	018F - 0190 SET BIT AND RETURN
004C CHECK FOR KEY PRESSED 004D RETURN IF KEY PRESSED	0192 - 019C TEST BIT AND RETURN ************************************
004E - 004F LOOP TILL KEY PRESSED	019D - 01C8 INKEY* ROUTINE 019D - 019E ADJUST AND SAVE ENCODED STATEMENT POINTER
0050 - 005F KEYBOARD LOOKUP TABLE	019F - 01A4 JUMP IF SHIFT @ WAS PRESSED
0050 ENTER = 0D	01A5 - 01A7 SCAN KEYBOARD 01AB - 01AA IF NO KEY PRESSED THEN JUMP
0051 SHIFT ENTER = 0D 0052 CLEAR = 1F	01AB SAVE CHARACTER 01AC - 01AF ZERO LAST KEY PRESSED STORAGE LOCATION
0053 SHIFT CLEAR = 1F	01BO A = STRING LENGTH
0054 BREAK = 01 0055 SHIFT BREAK = 01	01B4 GET CHARACTER
0056 UP ARROW = 5B 0057 SHIFT UP ARROW = 1B	0185 - 0188 SAVE STRING AND JUMP 018C - 01C8 SAVE READY MESSAGE AS STRING AND RETURN
0058 DOWN ARROW = 0A	**************************************
0059 SHIFT DOWN ARROW = 1A 005A LEFT ARROW = 0B	***************************************
005B SHIFT LEFT ARROW = 18 005C RIGHT ARROW = 09	01D3 - 01D8 RANDOM ROUTINE
005D SHIFT RIGHT ARROW = 19	01D9 - 01F7 CASSETTE ROUTINE
005E	01D9 - 01F7 MAKE A CASSETTE PULSE AND RETURN
0060 - 0065 DELAY LOOP	01FB - 01FD CASSETTE ROUTINE
0060 DEC COUNTER 0061 - 0062 TEST FOR ZERO	01F8 - 01FD TURN CASSETTE OFF AND RETURN
0063 - 0064 LOOP TILL ZERO 0065 RETURN	01FE - 0211 CASSETTE ROUTINE
#BC IS USED AS THE COUNTER	01FE - 0211 GET DRIVE NUMBER
0066 - 0074 NMI RESET	0212 - 021D CASSETTE ROUTINE
0066 - 0068 RESEI STACK POINTER	0212 - 021D DEFINE DRIVE AND RETURN
0069 - 006E TEST FOR DISK	***************************************
00oF - 0071	021E - 022B CASSETTE ROUTINE
THIS IS CALLED BY PRESSING THE RESET IN THE	021E - 022B RESET TAPE INPUT SO VIDEO DOES'T GO TO 32 CHARACTER MODE AND RETURN
BACK OF THE KEYBOARD	***************************************
0075 - 0104 INITIALIZATION ROUTINE	022C - 0234 CASSETTE ROUTINE
0075 - 007F MOVES LEVEL II POINTERS FROM ROM LOCATIONS 18F7 - 191D TO RAM LOCATIONS 4080 - 4086	022C - 0234 BLINK * DURING CASSETTE READ
0080 - 0089 SET LOCATION 41E5 - 41E7 TO INSTRUCTION	0235 - 0240 CASSETTE ROUTINE
LD A, (2COO)  008A - 0090 SET INPUT BUFFER POINTER (40A7) TO 41E8	0235 - 0236 SAVE BC AND HL
0091 - 009E SET DISK BASIC COMMAND VECTORS FROM 4152 - 41A5	0237 - 0238 SET COUNTER TO READ 8 BITS 0239 - 023B GET A BIT
TO JP 012D INSTRUCTION \$L3 ERROR\$  009F - 00A7 SET DOS EXIT VECTORS FROM TO RETURNS	023C - 023D LOOP TILL 8 BITS HAVE BEEN READ
00AB - 00AB ZERO START OF BASIC MEMORY 00AC - 00AE SET STACK POINTER TO 41FB	023E - 023F GET HL AND BC 0240 RETURN WITH BYTE READ IN A
OOAF - OOB1 CALL INITIALIZATION OF BASIC POINTERS AND VARIABLES ROUTINE	0241 - 0260 CASSETTE ROUTINE
00B2 - 00B4 CLEAR SCREEN	
0085 - 0087 POINT TO 'MEMORY SIZE?' MESSAGE 0088 - (08A DISPLAY IT	0241 - 0260 READ 1 BIT AND RETURN
OOBB - OOBD GET RESPONSE OOBE - OOBF IF BREAK PRESSED DO IT AGAIN	0261 - 0263 CASSETTE ROUTINE
OOCO - OOC3 IF THERE WAS A RESPONSE JUMP	0261 - 0263 WRITE A CLOCK PULSE
00C4 - 00D5 GET END OF COMPUTER MEMORY AND JUMP #THIS IS DONE IF YOU DON'T RESPOND TO MEM SIZE?#	0264 - 027D CASSETTE ROUTINE
OOD6 - OODB PUT BINARY OF RESPONSE IN DE OOD9 - OODC IF RESPONSE ISN'T RIGHT JUMP TO SN ERROR	0264 - 027D WRITE BYTE IN A AND RETURN
OODD - OODE HL = RESPONSE - 1	***************************************
OODF - OOE4 TEST TO SEE IF THIS LOCATION EXISTS OOE5 - OOE6     IF IT DOESN'T EXIST GET NEW RESPONSE	027E - 0292 CASSETTE ROUTINE
00E7 - 00EB TEST FOR MINUMUM RESPONSE 17428 00EC - 00EE IF BELOW THEN OM ERROR	027E - 0292 WRITE CASSETTE LEADER AND RETURN
OOEF - OOFB STORE MEMORY SIZE AND START OF STRING SPACE	0293 - 02AB CASSETTE ROUTINE
00F9 - 00FB CALL INITIALIZATION OF BASIC POINTERS AND VARIABLES ROUTINE	0293 - 02AB READ CASSETTE LEADER AND RETURN
OOFC - OOFE POINT TO 'RADIO SHACK LEVEL II BASIC' MESSAGE OOFF - O101 DISPLAY IT	02A9 - 0313 SYSTEM ROUTINE MENTRY POINT IS 02B2
0102 - 0104 JUMP TO READY ROUTINE	
0105 - 0110 'MEMORY SIZE' MESSAGE	02A9 - 02AE READ 2 BYTES AND SAVE THEM 02AF - 02B1 TURN CASSETTE OFF
0111 - 012C 'RADIO SHACK LEVEL II BASIC' MESSAGE	02B2 - 02B4 CALL DOS EXIT AT 41E2 02B5 - 02B7 SET ENCODED STATEMENT POINTER
***************************************	02BB - 02BA DISPLAY CARRIAGE RETURN
012D - 0131 L3 ERROR ROUTINE	02BB - 02BF DISPLAY \$ 02C0 - 02C2 GET RESPONSE
012D ~ 012E E = ERROR CODE	02C3 - 02C5 IF BREAK PRESSED THEN JUMP
012F - 0131	02C6 POINT TO 1ST CHARACTER INPUT 02C7 - 02C9 IF SN ERROR THEN JUMP
0132 - 019C GRAPHICS ROUTINE	02CA - 02CD
0132 - 013A PUT GRAPHIC CODE ON STACK:	02D1 - 02D3 READ 1 BYTE
O POINT -1 SET	02D4 - 02D7 IF NOT NAME HEADER THEN LOOP 02D8 - 02E6 READ NAME IF NO MATCH SKIP TO NEXT PROGAM
+1 RESET 013B - 013L CHECK SYNTAX	ON TAPE 02E7 - 02E9 BLINK \$
013D - 013F A = X VALUE	OZEA - OZEC READ 1 BYTE
	Map continues

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Map continued	
-	READ PROGRAM AND JUMP
***********	CASSETTE ROUTINE
************	READ 2 BYTES AND FUT IN HL
031D - 0329	COMPUTE JUMP ADDRESS AND GU BFOR , 88888 INPUT
032A - 0347	CUTPUT ROUTING
032A - 032B	SAVE BC AND CHARACTER TO SUTPUT
032E - 032E 032F - 0332	CHECK FOR DEVICE TYPE
0333 - 0334	GET CHARACTER TO DUTFUT AND BC
033 <b>8 -</b> 0337	SAVE BC AND CHARACTER 'C DUTPUT CALL DOS EXIT AT 41C1 CHECK FOR DEVICE TYPE BET CHARACTER TO DUTPUT AND BC IF CASSETTE THEN JUMP IF PRINTER THEN JUMP DISPLAY CHARACTER ON VIDEO AND UDATE CURSOR
033A - 0347	DISPLAY CHARACTER ON VIDEO AND UDATE CURSOR THEN RETURN BON ENTRY DEVICE TYPE FLAG (409C): -1 CASSETTE 0 VIDEO +1 PRINTER
	VIDEO RUJTINE
	CURSOR MAINTENANCE
***********	**************************************
0358 - 035A	CALL DOS EXIT AT 41C4 SCAN KEYBOARD AND RETURN WITH CHARACTER IN A
***********	SCAN FEYBOARD AND RETURN WITH CHARACTER IN A **********************************
0361 - 0367 0368 - 036A	ZERO LAST KEY PRESSED AND CURSOR POSITION CALL DOS EXIT AT 41AF
0.568	SAVE BL
0371 - 0373	GET START OF BUFFER AND LENGTH GET INPUT
0375 - 0378	SAVE FLAGS GET INPUT LENGTH AND END OF INPUT ZEKO END OF INPUT GET BC AND HL = START OF INPUT - 1
0379 - 037A 0378 - 0380	ZERO END OF INPUT GET BC AND HL = START OF IMPUT - 1
0381	GET BC AND ME = START OF TAPOT - I RETURN WITH CARRY IF BREAK WAS PUSHED CLEAR FLAGS AND RETURN
***********	CLEAR FLAGS AND RETURN ************************************
0384 - 0386	SCAN KEYBOARD
0387	CHECK FOR KEY PRESSED RETURN IF KEY PRESSED
0389 - 038A	LOOP TILL KEY PRESSED
038B - 039B	PRINTER ROUTINE
	SET CARRIAGE PUSITION TO START OF LINE
03 <b>9C - 03C1</b>	PRINTER ROUTINE
03C2 - 63E2	PRINT CHARACTER IN A
************	JUMP TO HPFROPRIATE DRIVER ADDRESS
03E3 - 0457	KEYBOARD DRIVER SCANS KEYBOARD AND RETURNS WITH BYTE
0458 - 058C	VIDEO DRIVER
058D - 05D8	DISPLAY BYTE AND RETURN
***********	PRINT BYTE AND RETURN ************************************
05D9 - 0673	INPUT INTO BUFFER #ON ENTRY HL = START OF BUFFER B = BUFFER SIZE
**************************************	WILL EXIT WITH CARRY IF BREAK PRESSED
0674 - 0675 0676 - 0680	TURN OFF CASSETTE SET UP RSTS, VIDEO, FEYBOARD, AND PRINTER DEVICE CONTROL BLOCKS IN RAM
0681 - 0684 0685 - 0686	SEND VALUE TO CASSETTE PORT
0685 - 068A 0688 - 0692	ZERO RAM LOCATIONS 4036 - 4062 IF BREAK PRESSED JUMP
0693 - 0695 0696 - 069E	SET STACK TO 4007  IF NON DISK JUMP
069F - 06A3	SELECT DISK O AS CURRENT DRIVE
06CC - 06D1	LOAD DOS LOADER AND JUMP JUMP TO READY ROUTINE
	FOR STORAGE LOCATION
06D2 - 0707	KST VECTORS AND DEVICE CONTROL BLOCK ARE STURED HERE
	SINGLE PRECISION ADDITION ROUTINES
	Map continues

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- 2. FRROR ON FRROR GOTO, ERL ERR RESUME.
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- 4. Others NOT supported: CDBL, CINT, CSNG, DEFFN, FIX, FRE.
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- 6. SOME BASIC COMMANDS MAY DIFFER IN ZBASIC. For instance, END jumps to DOS READY, STOP jumps to BASIC READY etc.
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#### **ZBASIC 2.2 SPEED COMPARISON DEMO**

To help give you an idea how fast compiled programs are, we have included this demo program

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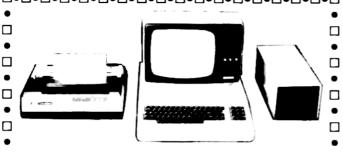
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Man postinued
Map continued 0708 - 070A POINT HL 10 .5 VALUE
070B - 070F LOAD BEDE WITH VALUE FOINTED TO BY HL AND JUMP 0710 - 0712 LOAD BEDE WITH VALUE POINTED TO BY HL
0713 - 0715 INVERTS THE VALUE IN REGI #SUBTRACTION 0716 - 0781 ADDS THE VALUES IN BODE TO REGI AND RETURNS
IF NG OV ERROR
0782 - 0786 OV EKROR ROUTINE
0782 - 0783 - E = ERROR CODE 0784 - 0786 - JUMP TO ERROR ROUTINE
07B7 - 07C2 SYSTEM MATH ROUTINE
######################################
07D7 - 07F7 SYSTEM MATH ROUTINE
######################################
**************************************
**************************************
**************************************
0897 - 0954 REG1 = BCDE / REG1
0955 - 0963 - SYSTEM MATH ROUTINE
1964 - 0976 SYSTEM MATH ROUTINE
0977 - 0989 REG1 = ABS(REG1)
98A - 0993 REGI = SGN(REGI)
0994 - 09A3 SYSTEM MATH ROUTINE
09A4 - 09B0 SINGLE PRECISION REGI TO STACK
09B1 - 69B3 LOAD VALUE POINTED TO BY HL INTO BCDE
0964 - 098F REG1 = BCDE
09BF - 09CA   LOAD VALUE IN BCDE TO LOCATION FOINTED TO BY HL
OPCE - OPCD HOVE REGI TO (HL) SINGLE ONLY
GOCE - GOD1 MOVE (DE) TO (HL.) SINGLE ONLY
09D2 MOVE (HL) TO (DE) FOR NTF BYTES
09D3 - 09D5 MOVE (DE) TO (HL) FOR NTF BYTES
09D6 MOVE (DE) TO (HL) FOR A BYTES
09D7 - 09DE MOVE (DE) TO (HL) FOR B BYTES
OPDF - OPF3 SYSTEM MATH ROUTINE
09F4 - OAOB SYSTEM MATH ROUTINE
OAOC - OA25 SINGLE PRECISION COMPARE REGI - BUDE
OAZ6 - OA38 SYSTEM MATH ROUTINE  1818181818181818181818181818181818181
ORSY - ORSE INTEGER CUMPARE HL - DE  \$888888888888888888888888888888888888
0A78 - OA7E DOUBLE PRECISION COMPARE REG2 - REG1
OAFF - OAA2 CINT(REGI) ROUTINE
0AA3 - OABO SYSTEM MATH ROUTINE
0AB1 - OADA CSNG(REG1) ROUTINE
OADB - OAF3 CDBL (REG1) ROUTINE
######################################
OBIF - OB25 SYSTEM MATH ROUTINE
######################################
######################################
0859 - 089F SYSTEM MATH ROUTINE
OBAO - OBAO SYSTEM MATH ROUTINE
OBAA - OBC6 SYSTEM MATH ROUTINE
OBC7 - OBD1 INTEGER SUBTRACTION HL = DE - HL
OBD2 - OBF1 INTEGER ADDITION HL = DE + HL
OBF2 - OCSA INTEGER MULTIPLICATION HL = DE * HL
OCSB - OCAF SYSTEM MATH ROUTINE
OC70 - OC76 DOUBLE PRECISION SUBTRACTION REG1 = REG1 - REG2
9C77 - 0D32 DOUBLE PRECISION ADDITION REG1 = REG1 + REG2
OD33 - OD44 SYSTEM MATH ROUTINE
Map continues

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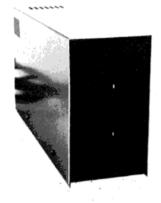
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#### Map continued

		******** SYSTEM M			*********	******	*****
					*********	******	*****
		SYSTEM M					
		SYSTEM M			*********	*******	*****
*****	*******					******	*****
ODA1 -					TIPLICATION		
*****		REG1 = R					
ODES -		DOUBLE P				•••••	
		REG1 = R					
		SYSTEM M			**********	*******	*****
							*****
		CONVERT	ASCII S	TRING	TO DOUBLE		
					TO STRING		
OEAC -					**************************************		
	0.07				TO STRING	MEGO INC.	-
					*********	*******	*****
		SYSTEM M					
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*****	*******	*******	******	*****	********	*******	*****
		SYSTEM M					
		CONVERT			######################################	*******	******
		ON EXIT					
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		VARIDUS			NES *********		
		SOR (REG1			•••••	•••••	•••••
*****	*******	*******	******	****		*******	*****
		EXP (REG1					
		RND (REG1			*********		
*****	*******	*******	******	*****	********	******	*****
		COS (REG1					
		\$\$\$\$\$\$\$\$\$ SIN(REG1			*********	*******	*****
*****	*******	*******	******	*****	*********		*****
		SYSTEM M					
					********	******	*****
		TAN (REG1			********	******	*****
		ATN (REG1					
					********	******	*****
		SYSTEM M			*********		
	18F6	CONTAINS	BASIC	COMMAN	ND ADDRESS	LISTS,	
		THE RESE	RVED WO	RD LI	BT, PRECEDE	NCE OPER	ATOR
		CONVERSI	ON BOUT	INFRI	DUTINES LIS LIST, AND E	T, DATA RROR MEG	RAGE
		LIST					
RESERV	ED WORD						
RESERV ABS	ED WORD	L18T:	GOSUB	91 16	EB1	READ	89 21EF
ABS AND	D9 0977 D2 25FD	L18T:	GOTO	91 16 8D 16	EC2	REM	93 1F07
ABS AND ASC	D9 0977 D2 25FD F6 2AOF	L18T:	GOTO IF	8D 18	EC2 039	REM RESET	93 1F07 82 0138
ABS AND ASC ATN	D9 0977 D2 25FD F6 2AOF E4 15BD	L18T:	GOTO IF	8D 18	EC2 039	REM RESET RESTORE	93 1F07 82 0138 90 1D91
ABS AND ASC ATN AUTO CDBL	D9 0977 D2 25FD F6 2AOF E4 15BD B7 2008 F1 0ADB	L18T:	GOTO IF	8D 18	EC2 039 19D AEF	REM RESET RESTORE RESUME	93 1F07 82 0138 90 1D91 9F 1FAF
ABS AND ASC ATN AUTO CDBL CHR4	D9 0977 D2 25FD F6 2AOF E4 15BD B7 2008 F1 0ADB	L18T:	GOTO IF	8D 18	EC2 039 19D AEF	REM RESET RESTORE RESUME	93 1F07 82 0138 90 1D91 9F 1FAF
ABS AND ASC ATN AUTO CDBL CHR4	D9 0977 D2 25FD F6 2AOF E4 15BD B7 2008 F1 0ADB	L18T:	GOTO IF	8D 18	EC2 039 19D AEF	REM RESET RESTORE RESUME	93 1F07 82 0138 90 1D91 9F 1FAF
ABS AND ASC ATN AUTO CDBL CHR\$ CINT CLEAR	D9 0977 D2 25FD F6 2A0F E4 15BD B7 2008 F1 0ADB F7 2A1F EF 0A7F B8 1E7A	L18T:	GOTO IF INKEYS INP INPUT INSTR INT KILL	8D 18 8F 20 C9 00 DB 26 89 20 C5 40 DB 01 AA 40 FB 26	EC2 039 19D AEF	REM RESET RESTORE RESUME	93 1F07 82 0138 90 1D91 9F 1FAF
ABS AND ASC ATN AUTO CDBL CHR® CINT CLEAR CLOAD CLOSE	D9 0977 D2 25FD F6 2A0F E4 15BD B7 2008 F1 0ADB F7 2A1F EF 0A7F B8 1E7A B9 2C1F A6 4185	LISTI	GOTO IF INKEYS INP INPUT INSTR INT KILL LEFTS LEN	8D 18 8F 20 C9 02 DB 26 89 22 C5 42 DB 01 AA 42 FB 26 F3 26	EC2 039 19D AEF	REM RESET RESTORE RESUME	93 1F07 82 0138 90 1D91 9F 1FAF
ABS AND ASC ATN AUTO CDBL CHR® CINT CLEAR CLOAD CLOSE CLS	D9 0977 D2 25FD F6 2A0F E4 15BD B7 2008 F1 0ADB F7 2A1F EF 0A7F B8 1E7A B9 2C1F A6 4185 84 01C9	LIST:	GOTO IF INKEYS INP INPUT INSTR INT KILL LEFTS LEN LET	8D 11 8F 20 C9 0: DB 26 89 2: C5 4: DB 01 AA 4: FB 26 F3 26 8C 16	EC2 039 19D AEF 19A 19D 837 191 A61 A62	REM RESET RESTORE RESUME RETURN RIGHT® RND RSET RUN SAVE SET	93 1F07 82 0138 90 1D91 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A 8E 1EA3 AD 41A0 83 0135
ABS AND ASC ATN AUTO CDBL CHR® CINT CLEAR CLOAD CLOSE CLS CMD	D9 0977 D2 25FD F6 2A0F E4 15BD B7 2008 F1 0ADB F7 2A1F EF 0A7F B8 1E7A B9 2C1F A6 4185 B4 01C9 85 4173	LIST:	GOTO IF INKEYS INP INPUT INSTR INT KILL LEFTS LEN LET LINE	8D 18 8F 20 C9 01 DB 26 89 21 C5 41 DB 01 AA 41 FB 26 F3 26 BC 16 9C 41	EC2 039 19D AEF 19A 19D 837 191 A61 463 F21	REM RESET RESTORE RESUME RETURN RIGHTS RND RSET RUN SAVE SET SGN	93 1F07 82 0138 90 1D91 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A 8E 1EA3 AD 41A0 83 0135 07 098A
ABS AND ASC ATN AUTO CDBL CHR® CINT CLEAR CLOAD CLOSE CLS	D9 0977 D2 25FD F6 2A0F E4 15BD B7 2008 F1 0ADB F7 2A1F EF 0A7F B8 1E7A B9 2C1F A6 4185 84 01C9	LIST:	GOTO IF INKEYS INP INPUT INSTR INT KILL LEFTS LEN LET LINE	8D 11 8F 20 C9 0: DB 26 89 2: C5 4: DB 01 AA 4: FB 26 F3 26 8C 16	EC2 039 19D AEF 19A 19D 837 191 A61 A03 F21 1A3 82E	REM RESET RESTORE RESTUME RETUMN RIGHT® RND RSET RUN SAVE SET SGN SIN SOR	93 1F07 82 0138 90 1D91 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A 8E 1EA3 AD 41A0 83 0135
ABS AND AGC ATN AUTO CDBL CHRG CINT CLEAR CLOAD CLOSE CLS CMD CONT COS	D9 0977 D2 25FD F6 2A0F E4 15BD B7 200B F1 0ADB F7 0A1F EF 0A7F B8 1E7A B9 2C1F A6 4185 B4 01C9 85 4173 B3 1DE4 BA 25F5	LIST	GOTO IF INKEYS INP INPUT INSTR INT KILL LEFTS LEFT LINE LINE LIST LOAD	8D 18 8F 20 C9 01 DB 26 89 21 C5 41 DB 01 AA 41 FB 26 FS 26 BC 16 BC 16	EC2 039 019D 019D 019D 019D 0337 1191 0403 F21 0103 0103 0103 0103 0103 0103 0103 01	REM RESET RESTORE RESUME RETURN RIGHTS RND RSET RUN SAVE SET SGN SIN SQR STEP	93 1F07 B2 0138 90 1D91 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A BE 1EA3 AD 41A0 0135 07 098A E2 1547 CD 13E7 CC 2B01
ABS AND AGC ATN AUTO CDBL CHR6 CINT CLEAD CLOSE CLS CHD CONT COS CSAVE CSAVE	D9 0977 D2 25FD F6 2A0F E4 15BD B7 2008 F1 0ADB F7 2A1F EF 0A7F B8 1E7A B9 2C1F A6 4185 B4 01C9 B5 4173 B3 1DE4 E1 1541 BA 2BF5 F0 0AB1	L18Tı	GOTO IF INKEYS INKEYS INPUT INSTR INT KILL LEFTS LEN LET LLINE LIST LLIST LOAD LOC	BD 18 BF 20 C9 01 DB 26 B9 21 C5 41 DB 01 AA 41 FB 26 F3 26 BC 16 F3 26 BC 16 F3 26 BC 16 F3 26 BC 16 F3 26 F3 26	EC2 039 039 039 039 049 190 050 050 070 070 070 070 070 070 070 07	REM RESET RESTORE RESTUME RETUMN RIGHT® RND RSET RUN SAVE SET SGN SIN SOR	93 1F07 82 0138 90 1D91 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A BE 1EA3 AD 41A0 83 0135 07 098A E2 1547 CD 1387
ABS AND AGC ATN AUTO CDBL CHRG CINT CLEAR CLOAD CLOSE CLS CMD CONT COS	D9 0977 D2 25FD F6 2A0F E4 15BD B7 200B F1 0ADB F7 0A1F EF 0A7F B8 1E7A B9 2C1F A6 4185 B4 01C9 85 4173 B3 1DE4 BA 25F5	LISTI	GOTO IF INKEYS INP INPUT INSTR INT KILL LEFTS LEFT LINE LINE LIST LOAD	BD 18 BF 20 C9 0: DB 2/ BS 21 DB 01 AA 41 FB 2/ FB 2/ BC 14 BA 21 BA 21 BA 4: BA 4: BA 4: BB 4 21 BB 5 21 AT 4: BB 6 4: BB 7 4:	EC2 )039 19D 14PD 14FF 19D 1837 19D 1837 1401 1841 1841 1842 1842 1844 1844 1844	REM RESET RESTORE RESUME RETURN RIGHTO RND RSET RUN SAVE SET SGN SIN SOR STEP STOP STRO	93 1F07 82 0138 90 1D91 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A 8E 1EA3 AD 41A0 83 0135 07 0984 CD 13E7 CD 2801 94 1DA9 F4 2836 64 2A2F
ABS AND AGC ATN AUTO CDBL CHR6 CINT CLEAR CLOAD CLOSE CLSE CMD CONT COSAVE CSAVE CSMG CVD CVS	D9 0977 D2 23FD F6 2AOF E4 153D B7 2008 F1 0ADB F7 2AIF EF 0A7F B8 1E7A B9 2C1F A6 4185 B3 1DE4 E1 154 BA 2BF5 F0 0ABB E8 4152 E6 4152 E7 4159	L18Tı	GOTO IF INNEYS INP INPUT INSTR INT KILL LEFTS LET LLINE LINE LIST LLIST LOAD LOC LOF LOG LPRINT	BD 18 GF 20 CP 01 BP 21 C5 41 DB 01 AA 41 FB 21 BC 18 FB 21 BC 18 BC 18 BC 18 BC 18 BC 41 BC 41	EC2 039 039 039 039 049 049 059 059 079 060 079 060 079 067	REM RESET RESTORE RESUME RESUME RETURN RIGHTS RND RSET RUN SAVE SET SGN SIN SQR STEP STRS STRP STRS STRS STRINGS SYSTEM	93 1F07 82 0138 90 1D91 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A 8E 1EA3 AD 41A0 83 0135 07 098A E 1547 CD 13E7 CC 2B01 94 1DA9 F4 2836 C4 2A2F AE 0282
ABS AND ASC ATN AUTO CDBL CHRO CINT CLEAR CLOSE CLOSE CND CONT COS CSAVE CSNG CVI CVI CVI CVI CVI DATA	D9 0977 D2 23FD F6 2AOF E4 1580 B7 20AB F1 0ADB F7 2AHF EF 0A7F B8 1E7A B9 2C1F A6 4185 B4 01C9 B5 4173 B3 1DE4 E1 1541 BA 2BF5 F0 0AB1 E8 4152 E6 4152 E7 4158 B8 1F05	LIST	GOTO IF INKEYS INP INPUT INPUT INSTR INT KILL LEFTS LEN LET LLET LLET LLIST LLIST LOAD LOC LOG LOG LOG LOG LOG LOG LOF LOG LOF LOG LOF LOG LOF LOG LOF LOG	BD 18 GF 20 CP 01 BP 21 BP 21 C5 41 DB 01 AB 41 FF3 27 BC 18 FF3 27 BC 18 FF3 41 EB 41 EB 41 EB 41 AF 21 AF	EC2 339 19D 14P	REM RESET RESUME RESUME RESUME RETURN RIGHT RND RSET RUN SAVE SET SET SOR STEP STOP STOP STRIMS SYSTEM TABE(	93 1F07 92 0138 90 1D91 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A BE 1EA3 AD 41A0 B3 0135 07 09BA E2 1547 CC 2B01 94 1DA9 F4 2836 C4 2A2F AE 02B2 BC 2137
ABS AND AGC ATN AUTO CDBL CHRO CINT CLEAR CLOAD CLOSE CLS CMD CONT COS CSAVE CSAVE CVI CVI CVS DATA DEF DBEF DBL	D9 0977 D2 23FD F6 2AOF E4 15BD B7 2008 F1 0ADB F7 2AH EF 0AFF B8 1E7A B9 2CH A4 4185 B4 01C9 B5 4173 B3 1DE4 E1 1541 BA 2BF5 F0 0ABI B8 4152 E6 4152 E7 4159 B8 1F05 DD 415B 98 1E95	LIST	GOTO IF INNEYS INP INPUT INSTR INT KILL LEFTS LET LLINE LINE LIST LLIST LOAD LOC LOF LOG LPRINT	BD 18 GF 20 CP 01 BP 21 C5 41 DB 01 AA 41 FB 21 BC 18 FB 21 BC 18 BC 18 BC 18 BC 18 BC 41 BC 41	EC2 )039 )19D  AEF 19D  837 19D  837 191  A61 A61 A61 A62 163 822 822 164 167 809 067	REM RESET RESTORE RESUME RESUME RETURN RIGHTS RND RSET RUN SAVE SET SGN SIN SQR STEP STRS STRP STRS STRS STRINGS SYSTEM	93 1F07 82 0138 90 1091 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A 8E 1EA3 AD 41A0 93 0135 07 098A E2 1547 CD 13E7 CC 2B01 94 1DA9 F4 2836 C4 2A2F AE 0282
ABS AND ASC ATN AUTO CDBL CHRG CINT CLEAR CLOAD CLOSE CLS CMD CONT COS CSAVE CSNG CVD CVI CVI CVI DEF DBL DEF INT	D9 0977 D2 23FD F6 2AOF E4 15BD F1 0ADB F1 0ADB F1 0ADB F2 0AF EF 0AFF B8 1E7A B9 2C1F A6 4185 B4 01C9 B5 4173 B3 1DE4 E1 1AB E1	LIST	GOTO INCEYS INKEYS INFU INFUT INSTR INT KILL LEFT LEFT LINE LET LIST LOAD LOC LOG LOG LOF LOG LOF LOG MERGE MIDS	BD 18 GF 20 CP 01 BP 21 BP 21 BP 21 BP 41 BP 41	EC2 )039 19D 14PD 14PD 18EF 19D 1837 19D 1819 1841 1841 1842 1822 1848 1844 1869 0867 197 709 1888	REM RESET RESTORE RESUME RETURN RIGHTE RND SAVE SET SGN SUR STEP STOP STOP STREP SYSTEM TAB( TAB( TAN THEN THES	93 1F07 82 0138 90 1D91 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A 8E 1EA3 AD 41A0 83 0135 07 098 C2 2547 CD 13E7 CC 2B01 94 1DA9 F4 2826 C4 2A2F AE 02B2 BC 2137 E3 15A8 CA
ABS AND AGC ATN AUTO CDBL CHRG CINT CLEAD CLOSE CLOSE CLOS CONT COST CONT COST CYD CVI DEF DBE DEF INT DEF SINT	D9 0977 D2 23FD F6 2AOF E4 153D B7 2008 F1 0ADB F7 2AIF EF 0A7F B8 1E7A B9 2C1F A6 4185 B4 01C9 B5 4173 B4 2BF5 F6 4152 B8 1F05 B8 1F05 B9 1E09 P9 1E03 P4 1E09 P9 1E03	LIST	GOTO IF INCEYS INCEYS INPUT INSTR INT KKILL LEFTS LEN LET LLINE LIST LLIST LLOAD LOC LOF LOC LOF LPRINT LSET MEM MEMERGE MIDS MKDS	BD 18 GF 20 DB 26 BP 21 CB 26 CB 26	EC2 0339 039 039 039 039 039 039 039 039 03	REM RESET RESTORE RESUME RESUME RETURN RIGHTS RND SAVE SET SGN SUR STEP STRINGS SYSTEM TAB TAB THEN TIMES TO	93 1F07 82 0138 90 1091 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A BE 1EA3 AD 419A BE 1EA3 AD 419A BE 2 1547 CD 13E7 CC 2B01 94 1DA9 F4 2B36 C4 2A2F AE 02B2 BC 2137 E3 15AB CA 4176 BD
ABS AND AGC ATN AUTO CDBL CHRO CINT CLEAR CLOSE CLOSE CMD CONT COS CSAVE CSAVE CVD CVI CVS DATA DEF STR DEF DBL DEF INT DEF SSR	D9 0977 D2 23FD F6 2AOF E4 15BD B7 2008 F1 0ADB F7 2AHF EF 0A7F B8 1E7A B9 2CIF A6 4185 B4 01C9 85 4173 B3 1DE4 E1 1541 BA 2BF5 F0 0ABI B8 4150 E6 4152 E7 4158 B8 1F05 D0 415B 98 1E00 99 1E03 9A 1E06	LIST	GOTO INCEYS INKEYS INFU INFUT INSTR INT KILL LEFT LEFT LINE LET LIST LOAD LOC LOG LOG LOF LOG LOF LOG MERGE MIDS	BD 18 GF 20 CP 01 BP 21 BP 21 BP 21 BP 41 BP 41	EC2 339 19D EEF 19A 19D 837 191 191 144 143 822 822 144 147 707 189 199 147	REM RESET RESTORE RESUME RETURN RIGHTE RND SAVE SET SGN SUR STEP STOP STOP STREP SYSTEM TAB( TAB( TAN THEN THES	93 1F07 82 0138 90 1D91 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A 8E 1EA3 AD 41A0 83 0135 07 098 C2 2547 CD 13E7 CC 2B01 94 1DA9 F4 2826 C4 2A2F AE 02B2 BC 2137 E3 15A8 CA
ABS AND AGC ATN AUTO CDBL CHRA CINT CLEAD CLOSE CLS CMD CONT COS CSAVE CSNG CVD CVS DATA DEF DEF DBL DEF INT DEF STR DELETE DIM	D9 0977 D2 23FD F6 2AOF E4 153D B7 2008 F1 0ADB F7 2AIF EF 0AFF B8 1E7A B9 2CIF A6 4185 B4 01C9 85 4173 B3 1DE4 E1 1541 BA 2BF5 F0 0ABI E8 415E E6 4152 E7 4159 B8 1F05 D0 4158 B8 1F05 D0 4158 B8 1F05 D0 4158 B8 1E00 P8 1E00 P8 1E00 P8 1E00 P8 2E08 B4 2E08	LIST	GOTO IF INCEYS INCEYS INP INP INP INSTR INT KILL LEFTS LEN LET LINE LLIST LOAD LOC LOF LOC LOF LOC LOF LOR HEM MERGE MIDS MKIS MKIS NAME	BD 18 BF 20 DB 22 DB 22 DB 01 AA 42 FF 3 27 BF 3 27 BF 3 27 BF 4 21 EB 4 4 EB 4 AB 4 AB 4 AB 4 AB 4 AB 4 AB 4 AB 4 A	EC2 039 039 039 039 049 049 059 059 079 060 079 070 070 070 070 070 070 070 070 07	REM RESET RESTORE RESUME RESUME RETURN RIGHTR RIGHT RUN SAVE SGN SGET RUN SGR STEP STRB STRP STRB STRB TAB TTAB THEN THEN TO TROFF TRON	93 1F07 82 0138 90 1D91 97 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A BE 1EA3 AD 419A BE 1EA3 AD 20135 07 09BA E2 1547 CC 2B01 94 1DA9 F4 2836 C4 2A2F AE 02B2 BC 2137 E3 15AB C7 4176 BD 97 1DF8 96 1DF7 BF 2CBD
ABS AND ASC ATN AUTO CDBL CHRO CINT CLEAR CLOSE CLOSE CND CONT COS CSAVE CSNG CVI CVI CVI CVI DEF DBL DEF INT DEF SNG DEFSSNG	D9 0977 D2 23FD F6 2AGF E4 135B B7 2008 F1 0ADB F7 20AF EF 0A7F B8 1E7A B9 2C1F A6 4167 85 4173 83 10E4 E1 1541 B8 1E7A E4 155 D0 0AB1 E8 415E E6 4152 E7 4159 B9 1E09 99 1E03 9A 1E06 B4 2BC6 BA 2608 B4 2BC6 BA 2608 B7 2E60	LIST	GOTO IF INKEYS I	BD 111 SC 9 00 BC 9 00 BC 9 00 BC 9 00 BC 9 00 BC 11 BC 11	EC2 0339 19D 14PD 14PD 18EF 19D 1837 1819 1841 1841 1842 1842 1844 1847 1846 1847 1848 1849 1848 1849	REM RESET RESTORE RESUME RESUME RETURN RIGHTO RND SAVE SET SGN SUR SUR STOP STOP STOP STREP STOP STREP STRINGO SYSTEM TAB( TAN THEN TO TO TROFF TRON USING USING USING USING	93 1F07 82 0138 90 1D91 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A 8E 1EA3 AD 41A0 83 0135 07 078 CC 2B01 94 1DA9 F4 282F AE 02B2 BC 2137 E3 15A8 CA 4176 BD 97 1DF8 96 1DF7 BF 2CBD 97 1DF8 96 1DF7 BF 2CBD 117FE
ABS AND AGC ATN AUTO CDBL CHRG CINT CLEAR CLOAD CLOSE CLS CMD CCONT COSAVE CSAVE CSA	D9 0977 D2 23FD F6 2AOF E4 125B B7 2008 F1 0ADB F7 2AIF EF 0AF B8 1E7A B8 1E7A B8 1E7A B8 1E7A B8 1E7A B8 1E8A E1 1541 BA 2BF6 E6 4152 E7 4158 B8 1F05 D9 1E00 P9 1E00	LIST	GOTO IF INFE INFE INPUT INSTR INT KILL LEFTS LEN LET LLIST LLIST LLOAD LOC LOF LOG LPRINT LSET MEM MERGE MILDS MIKIS NAME NAME NEM NEXT	BD 111 SC 20 BB 22 BC 32 BC 32 BC 34	EC2 0339 19D 19D 18EF 19D 187 19D 187 19D 187 19D 188 187 188 187 187 188 187 188 187 188 188	REM RESET ORE RESUME RESUME RETURN RIGHTO RND SAVE SGN SGET RUN SQR STEP STRINGO STRINGO SYSTEM TABN THEN TO TRON USING USA	93 1F07 82 0138 90 1D91 97 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A BE 1EA3 AD 419A BE 1EA3 AD 419A BE 1EA3 CO 1355 07 098 CO 2801 94 1DA9 F4 2836 C4 2A2F AE 0282 BC 2137 E3 15A8 CA 27 E3 15A8 CA 4176 BD 97 1DF8 96 1DF7 BF 2CBD C1 27FE FF 2AC5
ABS AND AGC ATN AUTO CDBL CHRG CLIST CLOAD CLOSE CLS CND CONT COS CSAVE CSAVE CSAVE CSAVE CSAVE CSAVE CSAVE CSID DEF INI DEF SNG DEF STR DELETE DIM EDIT ELSE END	D9 0977 D2 23FD F6 2AGF E4 125B B7 2008 F1 0ADB F7 2AIF EF 0AFF B8 1E7A B9 2C1F A6 4185 84 01C7 85 417 B4 2BF F0 0AFB B1 1541 B4 2BF F0 0AFB B1 1551 B4 2BF F0 0AFB B1 1505 B1 1505 B1 1505 B1 1505 B1 1505 B1 1506 B1	LIST	GOTO IF INEYS INEYS INPUT INSTR INT INSTR INT LEST LEFT LLIST LLIST LLIST LOAD LOG LPRINT LOGE LPRINT HERBE HKDS MKISS NAME NEXT NOT ON	BD 11 CF 20	EC2 0339 19D 14PD 14FF 19D 18FF 19D 1871 1811 1811 1812 1822 1822 1829 1844 1867 1869 1867 1877 1879 1888 1899 1888 1888 1899 1888	REM RESET RESTORE RESUME RESUME RETURN RIGHTO RND RSET RUN SAVE SET SGN STOP STRO STRO STRO STRO STRO STRO TAB ( TRO	93 1F07 82 0138 90 1D91 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A BE 1EA3 AD 41A0 B3 0135 07 098A E2 1547 CD 13E7 CC 2B01 94 1DA9 F4 2836 C4 2836 C4 2836 C5 127 E5 15AB CA 1DF8 97 1DF8 96 1DF7 BF 2CBD C1 27FE FF 2AC5 C0 24EB CD 24EB CD 24EB CD 24EB CD 24EB CD 24EB CD 24EB CD 24EB
ABS AND AGC ATN AUTO CDBL CLIRA CLORE CLOSE CLS CMD CONT COS CSAVE CSAVE CSNG CVD DEF DEF DBL DEF INT DEFSNG DEFSTR DELETE DIM ED JT ELSE END EGR	D9 0977 D2 23FD F6 2AOF E4 153D B7 2008 F1 0ADB F7 2AIF EF 0AFF B8 1E7A B4 1157 B4 4185 B4 1154 B4 2BF5 F6 4152 E6 4152 E7 4159 B8 1F05 D9 1E03 P9 1E03 P9 1E03 P9 1E03 P9 1E04 P1 1E0	LIST	GOTO IF INFE INFE INPUT INSTR INT KILL LEFT'S LEN LET LLINE LLIST LLIST LLOAD LOC LOF LOC LOF LPRINT LSET MEM MERGE MIDS MKIS MKIS MKIS NEM NEM NEM NOT ON OPEN	BD 11 CF9 20 CF9 20	EC2 339 19D 19D 19P 19P 190 191 191 191 191 191 191 191 191 191	REM RESET ORE RESUME RESUME RETURN RIGHT RND SAVE SGN SGET RUN SQR STEP STRE STOP STRE TABN THEN THEN THEN TINGS USR VAL VARPTR + -	93 1F07 82 0138 90 1D91 97 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A BE 1EA3 AD 419A BE 1EA3 AD 419A BE 1EA3 CO 198A CO 198A CO 198A CO 2801 P4 1DA9 F4 2836 CA 2137 E3 15AB CA 2137 E3 15AB E3
ABS AND AGC ATN AUTO CDBL CHRO CINT CLEAD CLOSE CLOSE CMD CONT COS CSAVE CSAVE CVI CVI CVI CVI DEFINT DEFSNG DEFINT DEFSNG DEFINT DELETE DIM EDIT ELSE END EOF ERR	D9 0977 D2 25FD F6 2AOF E4 15BD F7 2008 F1 0ADB F7 20AF EF 0A7F B8 1E7A B9 2CIF A6 4185 B9 2CIF A6 4185 E6 4152 E6 4152 E6 4152 E7 4159 B9 1E00 P9 1E03 P9 1E03 P9 1E03 P9 1E04 P9 1E04 P9 1E05 P0 1E0	LIST	GOTO IF INEYS INF INPUT INSTR INT INSTR INT LEST LEST LIST LOAD LOC LOG LOG LOG LOF LOG LOF HEH HEH HEH HEH HEKSS NAME NEXT NOT ON OPEN OR	8D 11 20 20 20 20 20 20 20 20 20 20 20 20 20	EC2 0339 19D 14PD 14PD 14PD 18B37 19D 18B1 16A7 16A7 16A7 16A7 16A7 16A7 16A7 16A	REM RESET RESTORE RESUME RESUME RETURN RIGHTO RND SAVE SET SGN SOR STOP STOP STREP STOP STREP STOP STREP TAB( TAB( TAN THEN TO THES TO USING USI	93 1F07 82 0138 90 1D91 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A 8E 1EA3 AD 41A0 83 0135 07 078 CC 2B01 94 1DA9 F4 2836 C4 2A2F AE 02B2 BC 2137 E3 15A8 CA 4176 BD 97 1DF8 96 1DF7 BF 2CBD 97 1DF8 96 1DF7 BF 2CBD C2 244E CD 244F CE 2532 CF
ABS AND AGC ATN AUTO CDBL CLIRA CLORE CLOSE CLS CMD CONT COS CSAVE CSAVE CSNG CVD DEF DEF DBL DEF INT DEFSNG DEFSTR DELETE DIM ED JT ELSE END EGR	D9 0977 D2 23FD F6 2AOF E4 153D B7 2008 F1 0ADB F7 2AIF EF 0AFF B8 1E7A B4 1157 B4 4185 B4 1154 B4 2BF5 F6 4152 E6 4152 E7 4159 B8 1F05 D9 1E03 P9 1E03 P9 1E03 P9 1E03 P9 1E04 P1 1E0	LIST	GOTO INCEYS INKEYS INKE	8D 11 6 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6	EC2 0339 19D 14P 14F 14F 14F 1819 1811 1841 1862 1862 1864 1863 1864 1866 1866 1866 1866 1866 1866 1866	REM RESET ORE RESUME RESUME RETURN RIGHT RND SAVE SGN SGET RUN SQR STEP STRE STOP STRE TABN THEN THEN THEN TINGS USR VAL VARPTR + -	93 1F07 82 0138 90 1D91 97 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A BE 1EA3 AD 419A BE 1EA3 AD 419A BE 1EA3 CO 135 07 09BA E2 1547 CD 13E7 CC 2B01 94 1DA9 F4 2B36 CA 2137 E3 15AB CA 2137 E3 15AB CA 15AB CA 15AB CA 25AB CA 25AB CA 27E CC 24EB CC 2532
ABS AND AGC ATN AUTO CDB1 CLIFA CLOAD CLOSE CLS CND CONT COS CSAVE CSAVE CSNG CVI CVI CVI DEF SNG DEF SNG DEF STR DELETE DIM EDIT ELIGE END EGRR ERROR ERROR ERROR EFIELD	D9 0977 D2 235D F6 267 E4 135D B7 2008 F1 0ADB F7 20AF EF 0AF B8 1E7 B8 1E7 B8 1E7 B9 10E4 E1 1541 BA 2BF F0 0ABB E8 415E E4 4152 E7 4159 BB 1E00 99 1E00 99 1E00 99 1E00 99 1E00 95 1F07 B0 1ABB E8 415E E8 415E E9 4161 E9 4161 E0 24D	LIST	GOTO IF INEYS INEYS INPUT INSTR INT INSTR INT LEST LEST LEST LLIST LLIST LOAD LOC LOF LOR LOR LOR HERBE MERBE MERBE MIDS MKISS NAME NEXT NOT OPEN OUT PPOINT	8D 11 20 20 20 20 20 20 20 20 20 20 20 20 20	EC2 0339 19D 14PD 14FF 14PD 18FF 18P1 18A61 18A61 18A61 18A61 18B8 16A7 18B8 16A7 16A7 16B8 16B8 16B8 16B8 16B8 16B8 16B8 16B8	REM RESET ORE RESUME RESUME RESUME RETURN RIGHT RIGHT RUN SET RUN SOR STOP STRINGS SYSTEM TAN THES TO TRONF USIN USIN VARP TR	93 1F07 82 0138 90 1091 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A BE 1EA3 AD 41A0 B3 0135 O7 0984 C2 1547 CD 13E7 CC 2B01 94 1DA9 F4 2B36 C4 2A2F AE 02B2 BC 2137 E3 15A8 CA 02B2 BC 2137 E3 15A8 CA 02B2 BC 2137 E3 15A8 CA 02B2 E3 15A8 CA 2FFE FF 2AC5 CD 244F CE 2532 CF DO D1
ABS AND AGC ATN AUTO CDBL CLIRA CLINT CLOSE CLOSE CLOS CMD CONT COS CSAVE CSAV	D9 0977 D2 2357D F6 264 F6 2456B F7 264F FF 64 155B F7 264F FF 64 4185 B8 1E7A B8 1E8A B8 1E8A B8 1E95 B8 1F05 B8 1F05 B9 1E09 P9 1E03 P9 1E03 P9 1E03 P9 1E04 P1 1E04	LIST	GOTO IF INFE INFE INPUT INSTR INT INT KILL LEFTS LET LLIST LLIST LLIST LLOAD LOC LOF LOC LOF LPRINT LSET MEM MEM MEM MEM MEM MEM NOT ON ON OUT PEEK POINT	BD 11	EC2 0379 0379 0379 0379 0379 0379 0379 0379	REM RESET ORE RESUME RESUME RETURN RIGHT RIGHT RIGHT RIGHT ROND SOR STED STRING STED STRING STRING STRING STRING THEM TO TRON USI R VARP T  *  *  *  *  *  *  *  *  *  *  *  *	93 1F07 82 0138 90 1091 97 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A BE 1EA3 AD 419A BE 1EA3 AD 419A BE 1EA3 CO 1587 CC 2801 94 1DA9 F4 2836 C4 2A2F AE 0282 BC 2137 E3 15A8 CA 176 BD 97 1DF8 96 1DF7 BF 2CBD C1 27FE C2 24EB C2 24EB C2 24EB C2 2532 CF D0 D1 D4 D5 D5 D6 D7 D7 D8 D8 D9 D9 D1 D9 D1 D9 D0 D1 D4 D5 D0 D1 D4 D5 D5 D6 D7 D7 D8 D8 D9 D9 D1 D7 D8 D9 D1 D7 D8 D9 D1 D7 D8 D9 D1 D7 D8 D1 D7 D8 D9 D1 D7 D8 D9 D1 D7 D8 D9 D1 D7 D8 D9 D1 D7 D8 D9 D1 D7 D8 D9 D1 D7 D8 D9 D1 D8 D9 D1 D8 D9 D1 D8 D9 D1 D8 D9 D1 D8 D9 D1 D8 D9 D1 D8 D9 D1 D8 D9 D1 D8 D9 D9 D1 D8 D9 D9 D9 D9 D9 D9 D9 D9 D9 D9
ABS AND AGC ATN AUTO CDB1 CLIFA CLOAD CLOSE CLS CND CONT COS CSAVE CSAVE CSNG CVI CVI CVI DEF SNG DEF SNG DEF STR DELETE DIM EDIT ELIGE END EGRR ERROR ERROR ERROR EFIELD	D9 0977 D2 23FD F6 2ASF E4 1580 F7 2008 F1 0ADB F7 20AF EF 0AFF B8 1E7A B9 20F A6 4185 B3 15E4 E1 18A 28F5 F0 0ABB B8 1F05 B9 1E03 B1 1E04 B1 1E04 B1 1E05 B1 1E07 B1	LIST	GOTO IF INEYS INF INF INPUT INSTR INT INSTR INT LEST LEST LIST LOAD LOC LOG LOG LOG LOF LOR LOF HEH MERGE MKJOS MKSS NAME NEXT NOT ON OPEN OUT POINT POIK POINT POIK	8D 11 20 20 20 20 20 20 20 20 20 20 20 20 20	EC2 3039 190 190 1819 1819 1819 1819 1819 1819	REM RESET ORE RESUME RESUME RESUME RETURN RIGHT RIGHT RUN SET RUN SOR STOP STRINGS SYSTEM TAN THES TO TRONF USIN USIN VARP TR	93 1F07 82 0138 90 1091 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A BE 1EA3 AD 41A0 B3 0135 O7 0984 C2 1547 CD 13E7 CC 2B01 94 1DA9 F4 2B36 C4 2A2F AE 02B2 BC 2137 E3 15A8 CA 02B2 BC 2137 E3 15A8 CA 02B2 BC 2137 E3 15A8 CA 02B2 E3 15A8 CA 2FFE FF 2AC5 CD 244F CE 2532 CF DO D1
ABS AND AGC AGTN AUTO CDBL CHRA CLINT CLEAD CLOSE CLAD CLOSE CLS CSAVE C	D9 0977 D2 2357D F6 264 F6 2456B F7 264F FF 64 155B F7 264F FF 64 4185 B8 1E7A B8 1E8A B8 1E8A B8 1E95 B8 1F05 B8 1F05 B9 1E09 P9 1E03 P9 1E03 P9 1E03 P9 1E04 P1 1E04	LIST	GOTO INCEYS INKEYS INKEYS INKEYS INFU INFUT INSTR INTI LEST LEST LLIST LLIST LLOAD LOC LOB LOC LOB LOF LOB LOF LOB LOF LOB LOS LOF LOB LOF LOB LOS LOF LOB LOS LOF LOB LOS LOF LOB LOF LOB LOS LOP LOB LOS LOP LOB LOS LOP LOB	8D 11 6 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6	EC2 3039 19D 14PF 14PF 14P1 14P1 14P1 14P1 14P1 14P1	REM RESET RESTORE RESUME RESUME RETURN RIGHT RIGHT RIGHT SGN SUR SUR SUR STOP STOP STRING SYSTEM TAB ( TAB THES TO TAB THES TO	93 1F07 82 0138 90 1091 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A BE 1EA3 AD 41A0 B3 0135 07 09BA E2 1547 CD 13E7 CC 2B01 94 1DA9 F4 2B3E C4 2B2F AE 02B2 BC 3 1DF8 97 1DF8 96 1DF7 BF 2CBD C7 4176 BD 10F7 BF 2CBD C7 449F C6 2532 C7 D0 D1 4 B5 4194
ABS AND AGC ATN AUTO CDBE CLIFT CLOAD CLOSE CLIS CMD CONT COS CSAVE CSAV	D9 0977 D2 235D F6 267 F6 276 F6 135D B7 2008 F1 0ADB F7 201F FF 0AF B8 1E7A B9 2C1F A6 4187 88 401C7 85 417 BA 2BF F0 0ABB E8 415E E4 415E E7 4159 B8 1E00 99 1E00 99 1E00 99 1E00 97 1E00 98 2BC6 BA 2608 97 1E00 98 1E00 F1 10AE E9 4161 C2 24DD C4 25C E7 115F E0 31470 F2 0B26 E8 4155 E1 1CA1 DA 27D4 A4 4174	LIST	GOTO IF INEYS INEYS INPUT INSTR INT INSTR INT LEST LEST LEST LLIST LOAD LOC LOF LOG LPRINT LOSE HERGE HIDS MKIGS NAME NEXT NOT OPEN OR OUT POINT POIK POINT POIK POINT POIK POINT PUT PUT INNEYS INT PUT INNE INC INT	8D 11 20 20 20 20 20 20 20 20 20 20 20 20 20	EC2 3039 190 190 1819 1819 1819 1819 1841 1841 1841 1862 1864 1877 1877 1888 1888 1888 1888 1888 188	REM RESET RESTORE RESUME RESUM	93 1F07 82 0138 90 1091 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A 8E 1EA3 AD 41A0 83 0135 07 0786 E2 1547 CD 13E7 CC 2B01 94 1DA9 F4 2836 C4 2A2F AE 02B2 BC 2137 E3 15A8 CA 02B2 BC 2137 E3 15A8 CA 176 BD 1DF7 BF 2CBD C1 27FE FF 2AC5 C0 244F CE 2532 CF D0 D1 D4 B5 D6 4194 FB
ABS AND AGC AGTN ALITO COBR CLIRA CLINA CLOSE CLOSE CLOS CMD COND COND COND COND COND COND COND CON	D9 0977 D2 2357D F6 264 F6 2405D B7 2008 F1 0ADB F7 261F EF 0A7F B8 1E7A B9 1E7A B9 1E7A B8 1E7A B8 1E7A B8 1E7A B8 1E7A B8 1E7A B8 1E8 B8 1E7A B8 1E8 B8 1E95 B9 1E09 P9 1E03 P9 1E03 P9 1E03 P9 1E03 P9 1E04 P0 1E04	LIST	GOTO IF INFE INFE INPUT INSTR INT INT INT INT KILL LEFTS LLET LLIST LLIST LLIST LLOAD LOG LPRINT LLOAD LOG LPRINT LSET MEM MEM MEM MEM MEM MEM MEM MEM PONE PONE PONE PONE PONE PONE PONE PONE	8D 11 6 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6	EC2 339 19D 19D 19P 19P 190 191 191 191 191 191 191 191 191 191	REM RESET RESTORE RESUME RESUM	93 1F07 82 0138 90 1091 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A 8E 1EA3 AD 41A0 83 0135 07 0786 E2 1547 CD 13E7 CC 2B01 94 1DA9 F4 2836 C4 2A2F AE 02B2 BC 2137 E3 15A8 CA 02B2 BC 2137 E3 15A8 CA 176 BD 1DF7 BF 2CBD C1 27FE FF 2AC5 C0 244F CE 2532 CF D0 D1 D4 B5 D6 4194 FB
ABS AND AGC	D9 0977 D2 23FD F6 2AOF E4 125BB F7 2AOF EF 0AFF F7 2AFF EF 0AFF EF 0AFF B8 1E7A B9 2C1F A6 4185 B8 1E7A B9 1E00 B9 1E	esasses DIVISION SESSESSES	GOTO IF INEYS INEYS INPUT INSTR INT INSTR INT INSTR INT LEFTS LET LET LIST LOAD LOG LOG LOG LPRINT LUSET MERGE MKIDS NAME NEXT NOT OPEN ON OPEN OUT PEEK POINT POKE PRINT LSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS	8D 11 6 7 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	EC2 0339 19D 14PD 14FF 19D 18FF 19D 1819 1819 1819 1811 182 182 182 182 182 182 184 186 187 187 187 188 189 189 189 189 189 189 189 189 189	REM TRESTORE RESUME RESUME RESUME RETURN RIGHTO RND SOR SSET SGN SOR STEP STRINGS SYBTEM TABN THEN TO TROOFF TO TROOFF USING U	93 1F07 82 0138 90 1D91 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A BE 1EA3 AD 41A0 83 0135 07 078 CC 2B01 94 1DA9 F4 2A2F AE 02B2 BC 2137 E3 15A8 CA 4176 BD 1DF8 96 1DF7 BF 2CBD C1 27FE FF 2AC5 CO 244F CD 244F CC 2532 CD 244F CD 2
ABS AND AGC ATN AUTO CDBL CLIRA CLOSE CLOSE CLS CMD CONT COS CSAVE CSNG CVD CVI CVI DEFINT DEFINT DEFINT DEFINT DEFINT ELIG END	D9 0977 D2 2357D F6 2AOF F6 2AOF E4 153D B7 200B F1 0ADB F1 0ADB F1 0ADB F1 0AF B8 1E7A B9 2CIF F6 4195 B8 1F70 B8 1E7A B9 2CIF F0 0ABI E8 4152 E6 4152 E6 4152 B8 1F05 D9 4158 B8 1F05 D9 4158 B8 1F05 D9 4158 B8 1E00 B8 2E00 P9 1E00 P0 1E0	******** DIVISION *********	GOTO INCEYS INKEYS INKEYS INKEYS INFU INFUT INSTR INT INSTR INT LEFT LLIST LLEN LET LLIST LLOAD LOC LOG LOG LOG LOR LOF LOG LOF LOG LOF LOSE HKDS HKDS HKDS HKSS NKSS NKSS NKSS NKSS NEXT NOT ON OOPEN OOR OPEN POINT POS PRINT RANDOM ISSUPPOR ISSUPPOR ISSUPPOR ISSUPPOR ISSUES ISSUPPOR ISSUES	8D 11 6 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6	EC2 0399 19D 14PD 14PD 14PD 14PD 14PD 14PD 14PD 14P	REM RESET RESTORE RESUME RESUME RETURN RIGHTS RND SAVE SET SGN SOR STEP STOP STRP STOP STRP STOP STRINGS SYSTEM TAB( TAN THEN TAB( TAN THEN TO TO TO SOR TAN THES TO SYSTEM TAB( TAN THES TO SYSTEM TAB( TAN THES TO TO STRINGS SYSTEM TAB( TAN THES TO STRINGS SYSTEM TAB( TAN THES TO STRINGS SYSTEM TAB TAN THES TO STRINGS SYSTEM TAB THES TO SYSTEM TAB THES THES THES SYSTEM TAB THES SYSTEM TAB THES THES THES SYSTEM TAB THES THES THES THES THES THES THES THES	93 1F07 82 0138 90 1091 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A 8E 1EA3 AD 41A0 83 0135 07 0135 07 025 CC 2B01 94 1DA9 F4 2836 C4 2A2F AE 02B2 BC 2137 E3 15A8 CA 4176 BD C1 27FE FF 2AC3 C7 4176 BD C1 27FE FF 2AC3 C0 244F CD 244F CE 2532 CF DO D1 D4 B5 D6 26 4194 FFB  *********************************
ABS AND AGC ATN AUTO CDBE CLIFF CLOAD CLOSE CLIS CMD CONT COSAVE CSAVE CVD CVD CTSAVE CVD DEF STR DEF STR DEF STR DELET DEF STR DELET END	D9 0977 D2 2357D F6 2405D F6 2405D F7 2405F F6 2475 FF 0475 FF	ESEE*ESEE DIVISION SEEEESEE BASIC VA	GOTO IF INEYS INEYS INPUT INSTR INT INSTR INT LEFT LEFT LLIST LLIST LLIST LLOAD LOG LPRINT LOGE LPRINT HERBE HKIDS MKISS NAME NEXT NON OPEN OOPEN OOPE	8D 11 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	EC2 0339 19D 14PD 14FF 19D 18FF 19D 1819 1819 1819 1811 182 182 182 182 182 182 184 186 187 187 187 188 189 189 189 189 189 189 189 189 189	REM RESET RESTORE RESUME RESUME RETURN RIGHTS RND SAVE SET SGN SOR STEP STOP STRP STOP STRP STOP STRINGS SYSTEM TAB( TAN THEN TAB( TAN THEN TO TO TO SOR TAN THES TO SYSTEM TAB( TAN THES TO SYSTEM TAB( TAN THES TO TO STRINGS SYSTEM TAB( TAN THES TO STRINGS SYSTEM TAB( TAN THES TO STRINGS SYSTEM TAB TAN THES TO STRINGS SYSTEM TAB THES TO SYSTEM TAB THES THES THES SYSTEM TAB THES SYSTEM TAB THES THES THES SYSTEM TAB THES THES THES THES THES THES THES THES	93 1F07 82 0138 90 1D91 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A BE 1EA3 AD 41A0 B3 0135 OT 25 CC 2B01 94 1DA9 F4 2836 C4 2A2F AE 02B2 BC 2137 E3 15A8 CA 4176 BD 1DF7 BF 2CBD C1 27FE FF 2AC5 C0 244F CC 2532 CF DO D1 D4 B5 D6 A194 B5 B5 B
ABS AND AGC ATN ALITO COBLE CLIRA CLICAD CLOSE CLICAD CLOSE CLOS CMD COND COND COND COND COND COND COND CON	D9 0977 D2 2370 D6 24 1550 B7 200B B7 200B B7 200B B7 200B B8 167A B9	esesses DIVISION SABSEC VESSES BABIC VESSES SERVICES	GOTO IF INEYS INEYS INPUT INSTR INT INSTR INT LEFTS LET LLIST LLIST LLIST LLOC LOF LPRINT LOC LOF LPRINT LSET MEMORE MEMO	8D 11 89 89 22 65 44 10 89 89 22 65 44 10 89 89 22 80 81 89 80 81 81 81 81 81 81 81 81 81 81 81 81 81	EC2 0399 19D 14PD 14PD 14PD 14PD 14PD 14PD 14PD 14P	REM RESET RESETORE RESUME RESUME RESUME RESUME RESUME RESUME RESUME RESUME RESUME ROBE SOR SOR STEP STRINGS SYSTEM TABN THEN TO TROOF TROOF TROOF USAL VARPTR +	93 1F07 82 0138 90 1091 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A BE 1EA3 AD 41A0 83 0135 07 098A E2 1547 CC 2B01 94 1DA9 F4 2836 C4 2A2F AE 0282 BC 2137 E3 15A8 CA 176 BD 10F8 96 1DF7 BF 2CBD C1 27FE FF 2ACS CO 24EB CD 24FF CE 2532 CF DO D1 D4 B5 D6 A174 B7 B7 1DF8 96 1DF7 BF 2CBD D1 27FE FF 2ACS CO 24EB CD 24FF CE 2532 CF D0 D1 D4 B5 D6 A174 B7 B7 B7 B7 B7 B7 B7 B7 B7 B7
ABS AND AGC ATN ALITO COBLE CLIRA CLICAD CLOSE CLICAD CLOSE CLOS CMD COND COND COND COND COND COND COND CON	D9 0977 D2 2370 D6 24 1550 B7 200B B7 200B B7 200B B7 200B B8 167A B9	esesses DIVISION SABSEC VESSES BABIC VESSES SERVICES	GOTO IF INEYS INEYS INPUT INSTR INT INSTR INT LEFTS LET LLIST LLIST LLIST LLOC LOF LPRINT LOC LOF LPRINT LSET MEMORE MEMO	8D 11 89 89 22 65 44 10 89 89 22 65 44 10 89 89 22 80 81 89 80 81 81 81 81 81 81 81 81 81 81 81 81 81	EC2 339 19D 19D 19P	REM RESET RESETORE RESUME RESUME RESUME RESUME RESUME RESUME RESUME RESUME RESUME ROBE SOR SOR STEP STRINGS SYSTEM TABN THEN TO TROOF TROOF TROOF USAL VARPTR +	93 1F07 82 0138 90 1091 9F 1FAF 92 1EDE F9 2A91 DE 14C9 AC 419A BE 1EA3 AD 41A0 83 0135 07 098A E2 1547 CC 2B01 94 1DA9 F4 2836 C4 2A2F AE 0282 BC 2137 E3 15A8 CA 176 BD 10F8 96 1DF7 BF 2CBD C1 27FE FF 2ACS CO 24EB CD 24FF CE 2532 CF DO D1 D4 B5 D6 A174 B7 B7 1DF8 96 1DF7 BF 2CBD D1 27FE FF 2ACS CO 24EB CD 24FF CE 2532 CF D0 D1 D4 B5 D6 A174 B7 B7 B7 B7 B7 B7 B7 B7 B7 B7

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Map continued
 1924 - 1928
                        ' IN ' MESSAGE
 1929 - 192F
                        'READY' MESSAGE
 BREAK' MESSAGE
  1936 - 1954 LOCATE FOR NEXT FRAME ON STACK ROUTINE
                       MEMORY MANAGEMENT ROUTINE
 1955 - 1962
 IF STILL IN INPUT PHASE THEN JUMP CHECK RESUME
 197E - 1985
1986 - 1989
 198A - 198D
198E - 1990
                        IF NR ERROR THEN JUMP
                        JUMP TO READY ROUTINE
                       JUMP TO READY ROUTINE
SAVE LINE MUMBER FOR LAST DATA STATEMENT
ENTRY POINT FOR SN ERROR
ENTRY POINT FOR /O ERROR
ENTRY POINT FOR NF ERROR
ENTRY POINT FOR RW ERROR
 1991
1997
 1994
 19A0
                        SAVE LINE NUMBER WITH ERROR TWICE
GET RETURN ADDRESS AFTER REINITIALIZTION
 19AB
        - 19AD
                        GET STACK ADDRESS
                       GET STACK ADDRESS
JUMP TO REINITIALIZE VARIABLES
ZERO BC
PUT ERROR NUMBER IN A AND C ALSO SAVE IT
SAVE LAST BYTE EXECUTED ADDRESS
 19B1
 1995
 1984 - 1986
                       PUT IT IN DE
IF STILL IN IMPUT PHASE THEN JUMP
SAVE ERROR ADDRESS
GET LAST BYTE EXECUTED ADDRESS
  9C0
 1901 - 1908
 19C9 - 19CB
19CC
19CD - 19CF
                        SAVE IT
                        SAVE IT
IF ON ERROR SET THEN JUMP
IF NESTED RESUME THEN JUMP
JUMP TO EXECUTION DRIVER FOR RESUME
ZERO ERROR OVERIDE FLAG
GET ERROR CODE
 19D0 - 19DA
19DB - 19DD
 19DE - 19E2
19E3 - 19E4
 19E5
 19E6 - 19E8
19E9 - 19EB
                        GOTO NEXT LINE ON VIDEO
POINT TO ERROR CODE TABLE
 19EC
19EF
                        CALL DOS EXIT AT 41A6
ZERO D
  19F0 - 19F4
                        DISPLAY ?
                        ADJUST ERROR CODE POINTER
DISPLAY ERROR CODE
 19F6 - 19FD
19FE - 1801
1802 - 1805
                        DISPLAY ERROR CODE
POINT TO 'ERROR' MESSAGE
SAVE LINE NUMBER WITH ERROR
DISPLAY 'ERROR' MESSAGE
GET LINE NUMBER WITH ERROR
IF INPUT PHASE THEN JUMP
IF LINE NUMBER NON ZERO THEN DISPLAY
        - 1A0B
  1404
  1808 - 1810
  1A18
                        SET CURRENT DUTPUT DEVICE TO VIDEO
  1A19 - 1A1B
  IAIC -
                        CALL DOS EXIT AT 41AC
TURN OFF CASSETTE
  1A1F - 1A21
                        TURN OFF CASSETTE
GOTO NEXT LINE ON VIDEO
DISPLAY 'READY' MESSAGE
IF SN ERROR JUMP TO EDIT MODE
GET CURRENT LINE NUMBER
TEST FOR AUTO MODE
IF NON AUTO THEN JUMP
GET CURRENT LINE NUMBER
  1A22
  1A25 - 1A2A
   A2B
  1A33 - 1A35
 1A36 - 1A3C
1A3D - 1A3E
  1A3F -
 1A42
1A43 - 1A45
                        DUTPUT CURRENT LINE NUMBER
                        SEARCH BASIC PROGRAM FOR CURRENT LINE NUMBER
IF MATCH FOUND DISPLAY # ELSE DISPLAY SPACE
GET INPUT
  1846 - 1848
1848 - 1853
```

```
GET CURRENT LINE NUMBER
IF BREAK PRESSED THEN JUMP
TURN OFF AUTO MODE
1A58 - 1A59
1A5A - 1A5D
1A5E - 1A5F
1A60 - 1A75
                IF NON AUTO THEN JUMP
FIGURE NEXT LINE NUMBER AND JUMP
**********
1A76 - 1A7A
1A78 - 1A7D
                   DISPLAY
                   IF BREAK PRESSED THEN JUMP
GET 1ST CHARACTER AND TEST FOR END OF STATEMENT
1A7E
1A81
1A84
                   IF END THEN JUMP
1 487
                   SAVE LINE NUMBER
POINT TO 1ST CHARACTER AFTER LINE NUMBER
1498
                   SAVE LINE NUMBER
                   ENCODE INPUT INTO TOKENS
GET LINE NUMBER
GET FLAGS
      - 1A9B
1490
1A9D
149E - 1440
                   SAVE ENCODED STATEMENT POINTER
1AA1
1AA4
1AA7
                   CALL DOS EXIT AT 4192
IF INPUT PHASE THEN JUMP
SAVE LINE NUMBER
     - 1AA3
- 1AA6
                   SAVE LINE LENGTH
188
                   SET FLAG TO INPUT PHASE
GET 1ST CHARACTER, SET FLAGS, AND SAVE BOTH
GET LINE NUMBER
1000
      - 100
      - 1AAF
1 ABO
1AB1 - 1AB3
1AB4
                   GET LINE NUMBER
1AB5 - 1AB7
                   SEARCH FOR MATCHING LINE NUMBER IN PROGRAM
                   SAVE MATCHING ADDRESS
                   SHIFT CLOSET LINE IF NO MATCH TO MAKE ROOM
1489 - 1488
                   GET LINE ADDRESS
GET FLAGS
1 ABD
                   SAVE LINE ADDRESS
IF MATCHING LINE NUMBER JUMP
     - 1ACO
LABE
1801
                   GET LINE ADDRESS
GET END OF BASIC PROGRAM
1AC2 - 1AC4
1AC5 - 1AC7
                   FIGURE NEW END OF BASIC PROGRAM
IAC9 - IACB
                   TEST OUT OF MEMORY
                   GET END OF BASIC PROGRAM
GET OLD END OF BASIC PROGRAM
1ACD - 1ACF
                   GET LINE ADDRESS
MOVE THE NEW LINE INTO MEMORY
1AD1 - 1AE8
1AE9 - 1AEB
1AEC - 1AEE
1AEF - 1AF1
                   ADJUST ALL THE LINE POINTERS
CALL DOS EXIT AT 4185
                    UPDATE POINTERS AND VARIABLES
1AF2 - 1AF4
1AF5 - 1AF7
                   CALL DOS EXIT AT 4188
                   GO GET NEW INPUT
                  1AFB - 1BOF
***********
182C - 1848 SEARCH FOR MATCHING LINE NUMBER ROUTINE
1B49
                   RETURN IF SN ERROR
184A - 184C
184D - 184F
                   CLEAR SCREEN
GET START OF BASIC PROGRAM
1950 - 1952
1953 - 1955
                   AUTO OFF
1956 - 1958
1959
                   ZERO 1ST TWO BYTES OF BASIC PROGRAM
POINT TO START OF VARIABLE TABLE
1854 - 185C
```

Map continues

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Map continued	
	THE POST TOTAL
185D - 1882 185D - 185F	RUN ROUTINE GET START OF BASIC PROGRAM
1860 1861 - 1863	DEC BY I SAVE IT
1864 - 1860 186E	SET ALL VARIABLES TO SINGLE PRECISION ZERO A
186F - 1871 1872 - 1873	SET NO ERROR FOR RESUME ZERO HL
1674 - 187F	ZERO BASIC FOINTERS
1880 - 1882 1883 - 1888	RESTORE DATA INITIALIZE VARIABLES POINTERS
188C - 188E 188F	CALL DOS EXIT AT 4188 GET RETURN ADDRESS
1890 - 1894	SET START OF STRING SPACE
1895 - 189A 1898 - 189E	SET STACK POINTER INITIALIZE CITERAL STRING POOL
18A1 ~ 18A6	SET DUTPUT DEVICE TO VIDEO AND TURN CASSETTE UFF ZERO A
18A8 - 18A9	ZERO HL
1BAA - 1BAC 1BAD	CLEAR FOR FLAG SIGNAL RUN MODE
1BAE 1BAF - IBB1	SAVE ENCUDED STATEMENT COINTER
1882	RETURN
1883 - 188F	INPUT ROUTINE
1883 - 1887 1888 - 1880	DISPLAY :> DISPLAY SPACE
1BBD - 1BBF	JUMP TO INPUT ROUTINE
1BCG - 1C8F	TOFENIZE STATEMENT ROUTINE
108F - 1095	FSI 1e CODE
1690 - 1691 1692	H - D RETURN IF NUT EQUAL
1693 - 1694	L - E
1095 ############ 1096 - 1040	RETURN
1096 1097	GET VALUE TO COMPARE POINT TO VALUE TO COMPARE AND SAVE RETURN
	ADDRESS
1098 1099 - 1696	COMPARE THE VALUES ADJUST RETURN ADDRESS AND SAVE IT
169B - 169D 169E - 16AG	IF NO SN ERROR THEN RST 10 JUMP TO SN ERROR ROU'INE
**********	****************
1CA1 - 1D10	FOR ROUTINE
1016 - 1077 1016 - 1021	BASIC INTERPERTER CHECK FUR SHIFT &
1D21 1D24	IF SHIFT @ THEN CALL ROUTINE
1025 - 1027 1026 - 1028	SAVE ENCODED STATEMENT POINTER GET NEXT CHARACTER
1020 - 1050 1031	IF MULTIPLE STATEMENT JUMP CHECK FOR SN ERROR
1052 - 1034	IF THEN JUMP TO SN ERROR ROUTINE
1035 - 1038 1039 - 1038	CHECK FUR END OF BASIC PROGRAM  IF THEN JUMP TO READY ROUTINE
1030 - 1043 1044 - 1049	SAVE LINE NUMBER 1F TRUFF THEN JUMP
1D4A	SAVE DE
1048 - 1046 1050 - 1052	DISPLAY < CONVERT LINE NUMBER AND DISPLAY IT
1053 - 1057 1056	DISPLAY GET DE
1059	GET ENCODED STATEMENT FUINTER
105A 105B - 105E	GET NEXT CHARACTER SET RETURN ADDRESS
1D5F 1D60 - 1D61	LE END DE STATEMENT RETURN CHECK FOR TOLEN
1062 - 1064	IF NOT THEN JUMF
1D65 - 1D75 1D76	FIGURE JUMP SAVE _1
1077	GET ENCLUTE STATEMENT POINTER
1D78 - 1D90	RST 10 CODE
1078 1075 - 1070	INC ENCODED STATEMEN' FOINTER BY : IF ALFHA RETURN
1D7D - 1D81 1D82 - 1D8F	IF SPACE THEN LOOP SET FLAGS FOR OTHER CHARACISES
1D90	RETURN
1D91 - 1D9A	RESTORE ROUTINE
	KEYBOARD ROUTINE
1D9B - 1D9D	SCAN KEYBOARD
1D9E - 1D9F 1DAO - 1DA4	IF NO KEY PRESSED RETURN  IF SHIFT @ WAIT TILL KEY PRESSED
1DA5 - 1DA7 1DA8	SAVE KEY ADJUST KEY
**********	
*********	STOP ROUTINE
	END ROUTINE
1DE4 - 1DF6	CONT ROUTINE
1DF7 - 1DFF	TRON ROUTINE
IDFB - IDFF	TROFF ROUTINE

1E00 - 1E3C DEFSTR ROUTINE
iede berom noorme
***************************************
1E03 - 1E3C DEFINI ROUTINE
***************************************
1E06 - 1E3C DEFSNG ROUTINE
***************************************
1E09 - 1E3C DEFDBL ROUTINE
**************************************
1E3D - 1E44 SYSTEM ROUTINE
1E45 - 1E4D SYSTEM ROUTINE
######################################
1E4F - 1E79 ASCII 10 BINARY ROUTINE
**************************************
1E7A - 1EA2 CLEAR ROUTINE
************************************
1EA3 - 1EBO RUN ROUTINE
***************************************
1EB1 - 1EC1 GOSUB ROUTINE
***************************************
1EC2 - 1EDD GOTO ROUTINE
***************************************
1EDE - 1F04 RETURN ROUTINE
***************************************
1F05 - 1F1F DATA ROUTINE
######################################
1721 - 1F68 LET ROUTINE
1F6C - 1FAE UN ROUTINE
**************************************
1FAF - 1FF3 RESUME ROUTINE
***************************************
IFF4 - 2007 ERROR ROUTINE
***************************************
2008 - 2038 AUTO ROUTINE
**********************
2039 - 2066 IF ROUTINE
***************************************
2067 - 20aE LERINT ROUTINE
**************************************
206F - 2166 PRINT ROUTINE
2169 - 2177 SET QUIPUT DEVICE TO VIDEO ROUTINE
***************************************
2178 - 217E '?REDO' MESSAGE
***************************************
217F - 2199 REDO ROUTINE
***************************************
219A - 21EE INPUT ROUTINE
***************************************
21EF 2285 READ ROUTINE
***************************************
2286 - 2295 'EXTRA IGNORED' MESSAGE
**************************************
2296 - 2285 DATA ROUTINE
2286 - 2323 NEXT ROUTINE
**************************************
2324 - 2708 EXPRESSION EVALUATION ROUTINES
***************************************
2709 - 27D3 MEM ROUTINE
***************************************
27D4 - 27F4 FRE ROUTINE
***************************************
27F5 - 27FD POS ROUTINE
***************************************
27FE - 2818 USR ROUTINE
***************************************
2819 - 2A2E EXPRESSION EVALUATION ROUTINES
2025 - 2044 - CT-1454 - COULTME
2A2F - 2A60 STRING\$ ROUTINE
201 - 200 - LEFT POUTINE
2A61 - 2A90 LEFTS ROUTINE
2A61 - 2A90 LEFTS ROUTINE
2A61 - 2A90 LEFT\$ ROUTINE  ***********************************
2A61 - 2A90 LEFTS ROUTINE  ###################################
2A61 - 2A90 LEFTS ROUTINE  ###################################
2A61 - 2A90 LEFTS ROUTINE  ###################################
2A61 - 2A90 LEFTS ROUTINE  ***********************************
2A61 - 2A90
2A61 - 2A90
2A61 - 2A90 LEFTS ROUTINE  ###################################
2A61 - 2A90
2A61 - 2A90 LEFTS ROUTINE  2A91 - 2A99 SIGHTS ROUTINE  2A9A - 2AC4 MIDS ROUTINE  2AC5 - 2ADE VAL ROUTINE  2ADF - 2AE6 SYNTAX CHECK ROUTINE  2AE7 - 2AEE DISK BASIC ROUTINE  2AE7 - 2AEA INP ROUTINE
2A61 - 2A90 LEFTS ROUTINE  ###################################
2A61 - 2A90 LEFTS ROUTINE  ###################################
2A61 - 2A90
2A61 - 2A90 LEFTS ROUTINE  2A91 - 2A99 SIGHTS ROUTINE  2A9A - 2AC4 MIDS ROUTINE  2AC5 - 2ADE VAL ROUTINE  2ADF - 2AE6 SYNTAX CHECK ROUTINE  2AE7 - 2AEE DISK BASIC ROUTINE  2AE7 - 2AFA INP ROUTINE  2AE7 - 2B00 OUT ROUTINE  2B01 - 2B28 EVALUATE EXPRESSION ROUTINES
2A61 - 2A90
2A61 - 2A90 LEFTS ROUTINE  ###################################
2A61 - 2A90
2A61 - 2A90
2A61 - 2A90 LEFT\$ ROUTINE  ###################################
2A61 - 2A90 LEFT4 ROUTINE  12A91 - 2A99 KIGHT4 ROUTINE  12A94 - 2AC4 MID4 ROUTINE  12A55 - 2ADE VAL ROUTINE  12A55 - 2ADE VAL ROUTINE  12A57 - 2AEE DISK BASIC ROUTINE  12A57 - 2AFA IMP ROUTINE  12A57 - 2B58 EVALUATE EXPRESSION ROUTINES  12A59 - 2B59 OUT ROUTINE  12B51 - 2B58 EVALUATE EXPRESSION ROUTINES  12B51 - 2B57 DUTPUT ROUTINE  12B52 - 2B7D OUTPUT ROUTINE  12B53 - 2B50 OUTPUT ROUTINE  12B55 - 2B50 DECODE ENCODED STATEMENT ROUTINE
2A61 - 2A90
2A61 - 2A90
2A61 - 2A90 LEFT4 ROUTINE  12A91 - 2A99 RIGHT4 ROUTINE  12A92 - 2AC4 MID4 ROUTINE  12A93 - 2AC4 MID4 ROUTINE  12A95 - 2AEE VAL ROUTINE  12AF - 2AEE DISK BASIC ROUTINE  12AF - 2AFA IMP ROUTINE  12AF - 2B90 OUT ROUTINE  12AF - 2B90 OUT ROUTINE  12AF - 2B90 LLIST ROUTINE  12B95 - 2B94 LIST ROUTINE  12B95 - 2B94 LIST ROUTINE  12B95 - 2B95 DECODE ENCODED STATEMENT ROUTINE  12B95 - 2B94 DELETE ROUTINE  12B95 - 2C1E CSAVE ROUTINE
2A61 - 2A90 LEFTS ROUTINE  12A91 - 2A99 RIGHTS ROUTINE  2A93 - 2AC4 MIDS ROUTINE  2A65 - 2A6E VAL ROUTINE  2A67 - 2A6E DISK BASIC ROUTINE  2A67 - 2A6A DUT ROUTINE  2A67 - 2B70 OUT ROUTINE  2B75 - 2B70 OUTPUT ROUTINE  2B75 - 2B70 OUTPUT ROUTINE  2B76 - 2B76 DECODE ENCODED STATEMENT ROUTINE  2B76 - 2B77 DELETE ROUTINE  2B76 - 2B78 DELETE ROUTINE  2B77 - 2A6A CLOAD ROUTINE
2A61 - 2A90 LEFT4 ROUTINE  12A91 - 2A99 KIGHT4 ROUTINE  12A92 - 2AC4 MID4 ROUTINE  12A95 - 2ADE VAL ROUTINE  12A97 - 2AEE DISK BASIC ROUTINE  12AF7 - 2AEA IMP ROUTINE  12AF7 - 2AFA IMP ROUTINE  12AF7 - 2B90 OUT ROUTINE  12AF8 - 2B90 OUT ROUTINE  12B91 - 2B98 EVALUATE EXPRESSION ROUTINES  12B91 - 2B98 EVALUATE EXPRESSION ROUTINES  12B97 - 2B90 OUT ROUTINE  12B97 - 2B90 OUT ROUTINE  12B97 - 2B90 OUTPUT ROUTINE  12B97 - 2B90 OUTPUT ROUTINE  12B98 EVALUATE APPRESSION ROUTINES  12B97 - 2B98 EVALUATE APPRESSION ROUTINES  12B99 - 2B99 EVALUATE APPRESSION ROUTINES  12B99 - 2B99 EVALUAT
2A61 - 2A90 LEFT\$ ROUTINE  12A91 - 12A99 KIGHT\$ ROUTINE  12A92 - 2AC4 MID\$ ROUTINE  12A94 - 2AC4 MID\$ ROUTINE  12A95 - 2ABE VAL ROUTINE  12A95 - 2AEE DISK BASIC ROUTINE  12A97 - 2AEE DISK BASIC ROUTINE  12A97 - 2AEA IMP ROUTINE  12A99 - 2B90 OUT ROUTINE  12A99 - 2B90 OUT ROUTINE  12A99 - 2B90 LLIST ROUTINE  12A99 - 2B90 LLIST ROUTINE  12B95 - 2B94 LIST ROUTINE  12B95 - 2B97 OUTPUT MESSAGE POINTED TO BY HL UNTIL O  1S FOUND  1S FOUND  2B96 - 2B94 DELETE ROUTINE  11A99
2A61 - 2A90 LEFTS ROUTINE  12A91 - 2A99 SIGHTS ROUTINE  2A91 - 2AC4 MIDS ROUTINE  2AC5 - 2ADE VAL ROUTINE  2ADF - 2AE6 SYNTAX CHECK ROUTINE  2AE7 - 2AEA DISK BASIC ROUTINE  11111111111111111111111111111111111
2A61 - 2A90 LEFT\$ ROUTINE  12A91 - 12A99 KIGHT\$ ROUTINE  12A92 - 2AC4 MID\$ ROUTINE  12A94 - 2AC4 MID\$ ROUTINE  12A95 - 2ABE VAL ROUTINE  12A95 - 2AEE DISK BASIC ROUTINE  12A97 - 2AEE DISK BASIC ROUTINE  12A97 - 2AEA IMP ROUTINE  12A99 - 2B90 OUT ROUTINE  12A99 - 2B90 OUT ROUTINE  12A99 - 2B90 LLIST ROUTINE  12A99 - 2B90 LLIST ROUTINE  12B95 - 2B94 LIST ROUTINE  12B95 - 2B97 OUTPUT MESSAGE POINTED TO BY HL UNTIL O  1S FOUND  1S FOUND  2B96 - 2B94 DELETE ROUTINE  11A99



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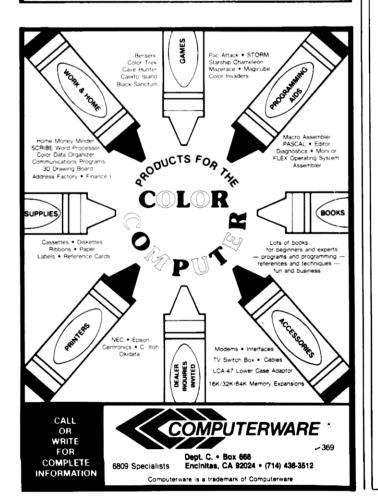
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```
Map continued
2CB1 - 2CBC
                POKE ROUTINE
2CBD - 2E52
              PRINTUSING ROUTINE
2E53 - 2E5F LINE NUMBER ROUTINE
2E53 - 2E56
2E60 - 2EE6
               EDIT ROUTINE
2FFB - 2FFF
                NOTHING HERE
3000 - 37DD RESERVED MEMORY
                MEMORY MAPPED INPUT/OUTPUT
37DE - 37FF
                DOS COMMUNICATION STATUS ADDRESS
37DF
                DOS COMMUNICATION DATA ADDRESS
                INTERRUPT LATCH ADDRESS
DISK DRIVE SELECT LATCH ADDRESS
37E0
37E1
                CASSETTE DRIVE LATCH ADDRESS
PRINTER PORT ADDRESS
37E2
37EC
                FLOPPY DISK CONTROLLER ADDRESS
KEYBOARD MEMORY
                                             G
3801
                             D
3802
3804
3808
3810
3820
                             ĎA
                                        RA
             CLS BRK
3880
       SHIFT
4000 - 4014
                RST JUMP VECTORS
4000
4003 -
       4005
                RST 10
       4008
                RST
4006
4009
     ~ 400B
                RST 20
400E
       4011
                RST 30
                    38
                ..........
*********
                KEYBOARD DEVICE CONTROL BLOCK
                DEVICE TYPE
DRIVER ADDRESS
4015
4018 - 401A
401B - 401C
                NOT USED
RAM BUFFER ADDRESS
                **********************************
*********
401D - 4024
                VIDEO DEVICE CONTROL BLOCK
401D
                DEVICE TYPE
                DRIVER ADDRESS
CURSOR POSITION
401E - 401F
4020 - 4021
                CURSOR ON/OFF
4022
                CURSOR CHARACTER
4023
                NOT USED
4025 - 402C PRINTER DEVICE CONTROL BL
                PRINTER DEVICE CONTROL BLOCK
                DEVICE TYPE
4025
                DRIVER ADDRESS
LINES PER PAGE
4026 - 4027
4028
4029
                LINES PRINTED SO FAR
                NOT USED
402A
               RAM BUFFER ADDRESS
402B - 402C
**********
402D - 4152
                COMMUNICATIONS REGION
                USED BY DOS
DIVISION SUPPORT ROUTINE
USER ADDRESS
402D ~ 407E
4080 - 408D
408E - 408F
                RANDOM NUMBER SEED
4093 - 4095
                 IN A.O
                OUT A,O
LAST KEY PRESSED AFTER BREAK
USED FOR RESUME
4096 - 4098
4099
409A
                NUMBER OF CHARACTERS IN PRINT LINE
DEVICE TYPE FLAG
409C
                 -1 CASSETTE
                 O VIDEO
                 +1 PRINTER
                SIZE OF VIDEO LINE
SIZE OF PRINTER LINE
409D
                RESERVED
START OF STRING SPACE POINTER
409F
4040 -
        4001
                 CURRENT LINE NUMBER
START OF BASIC PROGRAM POINTER
4004 - 4005
                 CURSOR POSITION
KEYBOARD BUFFER ADDRESS
CASSETTE INPUT FLAG
     - 40AB
 40A7
                O IF CASSETTE ELSE NON ZERO
RANDOM NUMBER SEED
4066 - 406D
                 VARIABLE FLAG
NUMBER TYPE FLAG
40AF
                2 INTEGER
3 STRING
4 SINGLE PRECISION
                  INTEGER
                 8 DOUBLE PRECISION
                 USED DURING EXPRESSION EVALUATION
 40BO
                 MEMORY SIZE POINTER
NEXT LOCATION AVAILABLE IN LITERAL STRING POOL
        40B2
 40B1 -
 40B3
        40B4
                LITERAL STRING POOL
USED FOR STRINGS
        40D2
 40D3 - 40D5
                 NEXT LOCATION AVAILABLE IN STRING SPACE
 40DB - 40D9
                 MULTIPLE USES
                                                      Map continues
```

```
Map continued
                LAST DATA STATEMENT READ LINE NUMBER
     - 40DB
                FOR FLAG
                O MOT IN PROGRESS
                USED DURING INPUT PHASE
40DD
                MULTIPLE USES
40DI
       40E0
                AUTO FLAG
U NO AUTO
CURRENT LINE NUMBER
AUTO INCREMENT
40E I
40E4
40E6
       40E5
                ENCODED STATEMENT FOINTER
40EB
       4069
                ERROR LINE NUMBER
                USED BY ERRUR
40E1
                LAST BYTE EXECUTED IN ERROR LINE
POSITION OF ERROR IN LINE
40± D
       40EE
40EF
                ON ERROR POINTER
4UF O
       AGE I
                ERROF FLAG
40F3
       40F4
                MULTIPLE USES
                LAST LINE RUN
40F 7
     - 40FB
40F9
       40FA
                VARIABLES POINTER
40FB
       40FE
                ARRAY POINTER
40FD
       40FE
                START OF FREE SPACE
       4100
                USED BY READ
4101
                VARIABLE DECLARATION TABLE
                TRACE FLAG
                 NON ZERO TRON
                USED BY MATH ROUTINES
411C
411D
     - 4124
                DE CL
                INTEGER
4110
                                                   1 96
                                                   LSB
4115
4121
                LSB
                                  LSB
4122
                                  LSB
4124
                USED BY MATH ROUTINES
REG2 SAME AS REG1
     - 412E
4127
4130
                PRINT BUFFER
                USED BY MATH ROUTINES
                *****************
                DISK BASIC LINKS
4152
4155
4158
       4157
415A
                CVS
415E
       4160
                CVD
4161
       4163
                EOF
4164
       4166
                LOC
4167
416A
       4169
                LOF
4 LAD
       414
       4172
4173
       4178
4178
4179
417C
417F
       417E
4181
                FIELD
4182
       4184
                PUT
4185
       4187
4188
       4184
                LOAD
4188
     - 418D
                MERGE
418E
       4190
4191
4194
     - 4193
                KILL
       4196
4197 - 4199
419A - 419C
                SET
4190
     - 4196
                 INSTR
     - 41A2
- 41A5
                LINE
41A3
...........
                             *******************
41A6 - 41E4
                DOS LINKS
                CALLED FROM:
41A9 - 41AB
41AC - 41AE
                2766
                 IAIC
414F
     ~ 41BI
                 OZAS
                 IAAI
        4184
4185 - 4187
                 1 AFC
                1AF 2
4186
      - 41 HD
41BE
                 2174
        4163
4161
                0320
4104 - 4106
                 0358
4167
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41D0
                2103
                 2108
41 D&
     - 41D8
                219E
     - 41E1
41DF
                 2944
                 0282
*********
                ****************************
A1ES - A1E7
                USED BY INPUT
41E8 - 42E7
                INPUT BUFFER
42EB
                ZERO
42E9 START OF BASIC PROGRAM MEMORY
```

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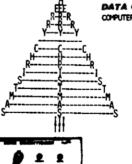
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### Actuators and energy translation.

### Cybernetics—Part III

Stephen Davids, President Robot Research and Development, Inc. Box 541 Station Z Toronto, Ontario Canada M5N 2Z6

n my previous two articles, I discussed the overall notion of a robot system and the specifics of sensors, as well as their interface to the TRS-80. This article covers actuators or output devices: their nature; modes of operation; and interface to the TRS-80. I will expand the bibliography started in Part Two of this series.

An actuator manipulates or alters the environment. The muscular system is the human's main output device, just as the nervous system is the main input device. The human system is effective but severely limited; it is capable of only sound, heat and motion output. Robots may emit light or other forms of electromagnetic radiation, or extend the range of motion, strength, or precision of the human form.

### **Energy Translation**

All output from any micro-312 • 80 Micro, December 1982

computer is in the form of electrical energy. The biological world does not generally make direct use of this electrical energy; we must first translate this energy into a more useful form (motion, light, heat, or sound).

The standard way to accomplish this translation is to interface the weak electrical output signals of the TRS-80 to an appropriate actuator giving the TRS-80 control of the output device as well as feedback on the performance of its commands.

This is a four part operation. First the TRS-80 must identify that it requires an output. During program execution, the TRS-80 encounters a conditional statement branching to an output subroutine. For example, a program input loop constantly monitors an infrared light sensitive detector diode on the robot's forehead. All night the robot waits for a high at that port address while it charges batteries. In the morning, as the first rays of light signal the start of a sunny day, the sensor drives the input port high. The program branches to the first line of an output subroutine.

The second part of this operation is the selection of an output device. Continuing the example, the robot now decides, on the basis of all information available to its sensors and the program it has been given by its creator, what to do now that the

sun has arisen. Assume the robot is plugged into a wall outlet to charge. Before going about its daily chores, it must disconnect itself from the power supply. I designed my robot outlet to greatly facilitate the plugging/unplugging operation. The robot retracts its connector to free itself and terminate the charging process. This is accomplished by a single sole-

must determine the state of the output port and act accordingly.

For example, if the actuator is a solenoid as above, the program could drive port address 05 high to signal the solenoid to pull the plug out from the wall.

The fourth part of the output operation is feedback. In my first article I stressed that a robot system without feedback is inherently unstable. In our ex-

"This system,
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noid, related to port address 05. The program determines that port address 05 is to be activated and moves to the next part of the operation.

The third part of the output operation is simple for our example, but could be complex for an analog output routine. The program must determine the correct value to be output to the actuator. The TRS-80 can drive the selected output high or low with respect to a reference voltage also on the output bus. The decoding circuit or interface

ample the system is unstable because the robot does not yet know that the plug has been extracted from the wall. A true servosystem compares the existing state to the desired state. The robot must determine if the cord is still attached to the wall. This may be done in many ways, such as checking the charging circuit to see if a current is still flowing, or trying to close a small trap door that contains the cord and the insert/withdrawal solenoid. If the door cannot close or the circuit is still

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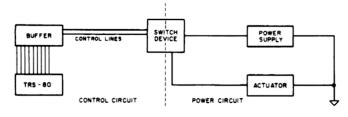


Fig. 1

functional, the program should jump to an error correction subroutine or try to extract the plug once more.

#### Circuits

In any device that comprises both decision logic and working circuits, there are voltages and currents potentially harmful to the more sensitive electronic parts. Actuators amplify the output signal of the microcomputer from logic levels to useful working levels. These working levels may range from 5 volts at several hundred milliamps to hundreds of volts at 40 or 50 amperes. Though the latter conditions are rare, it is common to switch 12 volts dc at 5 or 10 amperes,

enough to run small and medium dc motors. These conditions are sufficient to fry delicate electronic equipment like the TRS-80. With this in mind, before you hook up your TRS-80 to the vacuum cleaner, let's discuss some basic robotics.

There are two subcircuits in a robot output device. The control circuit includes the first output stage and the decision-base, in our case the TRS-80. The control circuit controls the behavior of the rest of the output device using the logic level voltages I have mentioned.

The *power* circuit is the business end of the system. The actuators and all other output devices are part of these cir-

cuits. A power circuit includes a power source and an actuator or effector. This circuit is a slave circuit, dependent upon the control circuit for commands (see Fig. 1).

When the control circuit receives an output command in the form of a varying voltage relative to an acknowledged ground, the command simultaneously appears in the power circuit to be amplified and interpreted by the whole process. The end result is a change in the actuator status.

Returning to my example, the small electrical signals on the output bus of the TRS-80 cannot operate the solenoid directly. This is where the power stage comes in. A 12 volt dc power supply forms a circuit with the solenoid and some type of switching device. When the switch is closed, current flows

through the solenoid coil pulling the metal plunger due to magnetic action similar to a speaker cone (see Figs. 2 and 3). The plunger is attached to the plug leading to the wall outlet so it extends when the solenoid is activated and is retracted by the action of an integral spring when the power circuit is open and the solenoid deactivated (see Fig. 4).

The voltage and current operating the solenoid are typical of levels dangerous to the TRS-80. An excellent design practice is to opto-isolate the control and power circuits (Fig. 5). An opto-isolator is an infrared LED emitter/detector pair in a single IC package. The theory of operation is simple. The LED emitter, part of the control circuit, is switched on and off by the buffered output from the TRS-80 at the expansion port. The detec-

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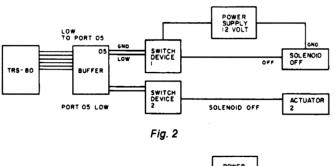
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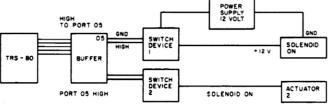


Fig. 3

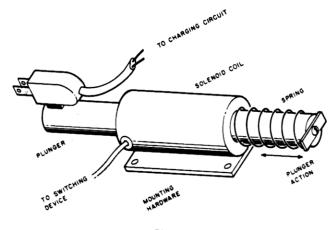


Fig. 4

tor acts as a switch electrically isolated from the emitter to about 3750 volts. When the emitter diode is on, the detector phototransistor turns on, allowing current flow to the actuator (see Fig. 6). If anything ever goes wrong electrically, the most expensive component, the TRS-80. is not destroyed.

I have assumed that the robot you are building has electrical actuators or effectors (these include motors, solenoids, lights, and amplifiers). Advantages to hydraulic and pneumatic systems are increased strength and speed. Indeed, most industrial robots are hydraulic at this time.

In a hydraulic or pneumatic robot the power circuit usually includes a control valve rather than the actuator itself. The best of these, called servovalves. monitor precisely the real state of the actuator through optical or electromagnetic transducer feedback loops. These feedback devices provide a very high precision control of the effector and an excellent repeatability of operation. This robot is excessively expensive to design and build and is outside the scope of this series of articles.

The motor is probably the most useful actuator available to the robot builder. When inter-

### CONTROL CIRCUIT POWER CIRCUIT PHOTOTRANSISTOR DETECTOR Fig. 5 3750 VOLT ISOLATION POWER DETECTOR ACTUATOR OPTOISOLATOR DETECTOR ACTUATOR ON Fig. 6

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Fig. 7

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facing a motor to the TRS-80 first consider what function that motor is to serve. This will help decide the type and size of motor and speed and voltage requirements. Sometimes the controlling speed is critical, as in the main drive motors responsible for propulsion. You can build a phase locked servosystem that contains feedback from a slotted disk rotating in synchronization with the motor output shaft (see Fig. 7). For a more complete discussion of phase locked servosystems, refer to the list of references.

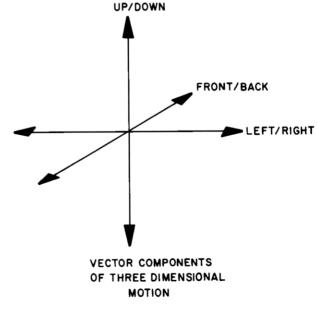
#### **TRS-80 Limitations**

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We must face the fact that the TRS-80 is not the fastest microcomputer designed; while it is functional as a robot brain, we should not challenge it with too many important tasks at any one instant. Clever programming of the TRS-80 allows a small number of simultaneous motions such as traversing the living room floor while playing the national anthem and waving a small flag. The programmer must develop an internal list of priorities to ensure that the main processor is mainly reading inputs rather than controlling the behavior of the outputs. One way to achieve this is to put the burden of counting repetitive motions or monitoring speed on an external circuit. The TRS-80 signals the external circuit, called an output controller. as to the required behavior of its actuator. The output controller directly drives the actuator and monitors the actuator's behavior, looking for the completion of the task assigned by the TRS-80 or a failure. In either case the output controller signals the TRS-80 and awaits the next instruction. This way the TRS-80 has much less to do with each actuator, and can handle a greater number of tasks than if it directly controlled every function. This system, called distributed processing, is on the very frontier of cybernetics.

Another method of reducing the demand placed on the TRS-80 by complex motion of an actuator such as a manipulator arm is to reduce the required motion into three single axis motion vectors. If an arm manipulator (actuator) must move from a start position to a finish position possessing different coordinates in three dimensional space, the path trajectory requires an integration formula that would weaken the knees of the brightest mathematical geniuses. Most robot builders would consider early retirement. The solution is to consider each motion as being composed of three separate straight line motions: left or right; forward or back; and up or down (Fig. 8). To truly simplify the motion, we can design a manipulator on these same straight lines





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and avoid the time-consuming mathematics.

There are several ways to translate the rotational motion of the motor into a linear motion. Linear (or translational) motion is extremely useful in push/pull applications. One manufacturer makes a ball bearing device accomplishing this within the price range of the hobbyist (see list of references).

The stepper motor is a special type of motor whose speed, direction of rotation and degree of rotation can be controlled by commercially available controllers interfaced to the logic level signals at the TRS-80 edge connector output bus. Manufacturers of computer peripherals such as disk drives and printers commonly use these expensive stepper motors. If your robot budget can handle this expense, I highly recommend the investment.

The final schematic may be found in the TRS-80 Microcomputer Technical Reference Handbook on pages 84-89, published by Radio Shack, for the interface buffer required for actuator interface. I have not used this circuit before. By all means try it yourself and inform me of your successes with this or any other robot circuit.

Stephen Davids has designed and developed some of the world's most fascinating robot systems, including talking vending machines, robot waiters and K-9, the robot dog.

### References

Craig, John. "Digital Speed Control of DC Motors." Robotics Age, Summer, 1980. Dorf. Modern Control Systems. Addison-Wesley, 1974. Gupton, James. "Unicorn-1 Robot." Radio-Electronics, August to January, 1980. Reichardt, Jasia. Robots, Fact, Fiction and Prediction. New York; Penguin Books, 1978.

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### Convert Fortran and muMath and learn some tricks.

# Model III Machine-Language Modifications

Richard Koch 2740 Washington Street Eugene, OR 97405

With a push from the Federal Communications Commission, Radio Shack launched the Model III in September, 1980. At that time, the company announced that "virtually all our software and most non-Radio Shack software for the Model III." It gradually became clear last year that this statement applies only to programs written in Basic; machine language programs

The Key Box

Basic Level II Model III 48K RAM TRSDOS 1.3 1 Disk Drive usually require modification.

I will report here on a project to modify two Model I programs, muMATH from the Soft Warehouse by way of Microsoft, and Fortran, from Microsoft by way of Radio Shack. Model III versions of these programs should be available soon from the suppliers. Although I give explicit details for modifying the programs, the main purpose of this article is to describe the type of code which can fail on the Model III.

If you want to make the modifications without reading about the details, refer to the end of this article where I have collected the required changes. I have a confession to make: Not all bugs in Fortran have been removed. I need help from readers with one problem I will explain later.

### **Preliminaries**

I modified Scripsit, the Editor/ Assembler, APL80, and MMS-FORTH before modifying Fortran. Unhappily, most lessons learned from these programs were irrelevant for Fortran, but the lessons may interest you.

The authors of many of these

programs changed the keyboard routine. They provided a flashing cursor or debounce or special purpose keys. Typically,

program name: INIT name for search: \$INIT name for search: name for search: \$IOFLG define size of data: define program size: 15 00 set loading counter: 00 00 set loading counter: 01 00 set loading counter: 02 00 set loading counter: ΔF data relative: 00 00 data relative: 01 00 program relative: 14 00 00 00 2A 49 40 Figure 1

they loaded location 4016 in the keyboard device control block (DCB) with the new keyboard driver address (all addresses in this article will appear in hex). Since the Model III keyboard DCB has not been changed, the

new keyboard routines would have worked had they not contained surprises.

Most new routines only contain code for the beginning of the routine. Then they jump into the middle of the old ROM code. Addresses in the *middle* of ROM routines are different on the Model III, and such code will not work.

This kind of difficulty was easy to repair. First I searched the code for the address 4016. The instruction containing this number was usually LD (4016), HL and the address of the new driver then became clear. If this driver contained jumps back into ROM, I would use the regular Model III driver. When that failed, I would compare the Model I and Model III keyboard ROM routines and find the address to jump into on Model III.

The keyboard driver problem was the most serious difficulty I encountered in earlier modification projects. Fortran just uses the Model III ROM routine.

The printer routine often caused trouble. The documented printer routine at 3B has not changed, but many software authors wrote their own routines instead. In that case I

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Location	New Code	Old Code
6C66	000000	321543
87B6	000000	321543
6C61	000000	221343
87C5	000000	221343
6FF4	4B44	7344
87DA	21FFFE	2A4940
6FA6	00FF	C05F
6FAE	OOFF	C05F
720B	OOFF	C05F
72F8	00FF	C05F
7307	00FF	C05F
730D	00FF	C05F
7318	OOFF	
736E		C05F
	OOFF	C05F
73A1	00FF	C05F
772B	00FF	C05F
7741	00FF	C05F
7759	00FF	C05F
7770	00FF	C05F
7E58	00FF	C05F
7FB0	00FF	C05F
7215	05FF	C55F
72CA	0BFF	CB5F
721B	782004FE8018	CA2A7278E67
7221	06B720031B18	C2287278EE8
7227	05FE81380113	47181B7887D
722D	000000	307213
784D	2100000909B7	E67F7E21FEF
7853	20032B1805FE	CA5878EE808
7859	813801230000	DA5D7823090
7F74	2811FE1C37C2	CA7A7FFE1C
7F7A	AC673AA85FE6	C2AC67E521/
7F80	7F4F06000936	5F5E2356237
7F86	1AD1C1E1C9	23666FCDF6
5200	C30061	C3B587
6100	222061213061	00000000000
6106	1140FF013800	00000000000
610C	EDB02A2061C3	00000000000
6112	B587	0000
6130	215EFF7EB736	00000000000
6136	00211E5FC23B	00000000000
613C	79E1C31079E5	00000000000
6142	215EFF38FFE1	00000000000
6148	E3E1E3C3F278	
614E	0000CDE07F21	000000000000
6154	4AFF36C3C9E5	00000000000
615A		000000000000
6160	214AFF36C221	00000000000
	5EFF3600E1C3	000000000000
6166	0277	0000
62C3	69FF	0277
72FA	CD60FF	CDE07F
78EF	C351FF	E3E1E3
7938	C340FF	211E5F

Location	Old Code	New Code
63D4	916F	2542
63DD	916F	2542
64B8	916F	2542
6367	E06F	6042
6406	E06F	6042
640F	E06F	6042
642D	E06F	6042

Table 1. Changes for muMATH (either 32K or 48K version)

changed the instruction LD (37E8),A for printing the contents of the accumulator to the equivalent new instruction OUT (0F8H),A. Fortran uses the ROM routine and needs no change.

When I began this game, I was frightened most by pro-322 • 80 Micro, December 1982

grams with extensive calls to the arithmetical routines in ROM. For example, APL80 uses the Basic ROM to add numbers. multiply them, compute square roots, calculate sines, and so on. The floating point package for MMSFORTH also calls ROM routines. The good news is that the arithmetical ROM routines have not changed locations in Model III, and programs which use them are as easy to modify as other programs. Fortran does not use the arithmetical ROM routines.

Finally, the routine which sets the top of memory is usually incorrect. There are four techniques here. Some programs like Checkers-80 simply use 16K and have no need for additional

memory. Other programs come on a disk containing several versions for different memory capabilities; for example, the mu-MATH package contains a 32K version and a 48K version. Some programs find the top of memory by directly testing location FFFF and working down until a live cell is found; APL80 and Scripsit work like that. (Such programs wipe out protected code at the top of memory, so readers with serial printer drivers or other routines there will have to make changes.) The most sophisticated technique for finding the highest memory location is to ask the DOS. Model I DOS stores the highest available memory at location 4049 and Model III DOS stores the information at 4411.

Fortran examines location 4049 to find the top of memory. I will begin the modification at that point.

#### **Review of Fortran**

The Fortran disk contains three programs and an additional library file. The programs are called EDIT/CMD, F80/CMD, and L80/CMD; the additional file is called FORLIB/REL. Microsoft constructed the package to accommodate writing and running very large Fortran programs. Consequently, at any moment the computer memory contains only the code to do the task at hand.

Edit is an editor to simplify typing text into the computer; it works like the Basic editor or the editor portion of EDTASM. When a program is complete, it is written to the disk and the Edit program is erased.

Unfortunately, Edit is a complicated program. It caused most of the trouble in the project. Microsoft has written Edit to use with programs too large for the computer memory. Old programs are not read back into memory for reediting. Instead, the computer stores only changes and additional text in memory and reads from disk when it refers to earlier material. Thus, Edit must be able to work with two files simultaneously when writing a reedited program back to disk. Even a third file can complicate this process, for when a large file is written to the

disk, Edit also writes a small "index file" of vital information about the large file for faster processing.

After you write a program, the compiler F80 converts it to code. This program also juggles three files at once. If you call your program EXERCISE, you must save it from the editor with the extension /FOR. The compiler pro-

Location	Old Code	New Code
78C5	4940	1144
575B	321543	000000
7C09	321543	000000
5767	221343	000000
7C0F	221343	000000
795C	7344	4B44
797F	7344	4B44
7999	7344	4B44

Table 3. F80/CMD Changes

Location	Old Code	New Code
5214	4940	1144
5204	321543	000000
582A	321543	000000
5210	221343	000000
5830	221343	000000
5D0C	7344	4B44

Table 4. L80/CMD Changes

duces a machine language version of the program on a file called EXERCISE/REL. It also produces an Assembly language version of the code which you can list and inspect; this file is called EXERCISE/LST.

The program EXERCISE/REL is not in a form which can run directly from the computer. One of Fortran's most important features is its ability to handle precompiled subroutines. Suppose you often need a routine called Matrix (no need to explain what it does). You can write the program Matrix only once and compile it to MATRIX/REL code. When the program EXERCISE/ FOR uses Matrix, include the line CALL MATRIX in the text. Even though Matrix appears nowhere else in the program, the compiler will not complain. But you must merge or link the file MATRIX/REL together with EX-ERCISE/REL before you can run the program. L80 does this linking. It converts EXERCISE/REL and any routines it uses into a single runnable file called EXERCISE/CMD. Many commonly used routines are included in the file FORLIB/REL; the linker must always merge at least these programs with the EXERCISE/REL file.

In summary, during a Fortran session with Exercise the disk may contain EXERCISE/FOR, EXERCISE/ZFO (the index file), EXERCISE/REL, EXERCISE/LST, and EXERCISE/CMD. The Fortran package juggles them, and every routine doing the juggling can cause trouble on the Model III.

### First Steps

I am using version 1.0 of Fortran. Use DOS 1.3 during the modification; the "end of file" protocol in earlier versions of DOS is incompatible with the modifications we will make.

The first change is easy. The three programs Edit, F80, and L80 find the top of memory by examining location 4049; we

must change this number to 4411. Use Patch to change 4940 to 1144 at location 87DB in EDIT/CMD, at location 78C5 in F80/CMD, and at location 5214 in L80/CMD.

These changes do not end our "top of memory" problems. Fortran programs created by the system still use location 4049 to find the top of memory. Solving this Model III. During these programs, a (perhaps accidental) press of the Break key causes you to fall back into Debug. This dismaying response can, of course, be deactivated.

Location 4315 controls the action of the Break key. It contains C3 when the Break key is activated and 00 when it is inactive. All three of our packages

"The Fortran system tracks related files by giving them the same first name with different extension names."

problem is much more difficult (and much more fun); it will be the last step of our modification.

If you did not own a Model I you may never have heard of the Break key's idiosyncracies. On the Model I, this Break key is "activated" by turning on Debug. After leaving Debug, you can run programs as on the

contain code which sets this location to 00 at the start of the program and to C3 when it ends. We must eliminate this code. Replace 321543 by 000000 at locations 6C66 and 87B6 in EDIT/CMD, at locations 575B and 7C09 in F80/CMD, and at locations 5204 and 582A in L80/CMD.

Our programs also temporarily

replace the contents of location 4313 on startup and return these contents to normal before ending. Documentation I own claims this location is a "jump director for positive DOS commands." The Model III has different code near 4313. So we eliminate manipulation of address 4313 by changing 221343 to 000000 at locations 6C61 and 87C5 of EDIT/CMD, at locations 5767 and 7C0F of F80/CMD, and at locations 5210 and 5830 of L80/CMD.

The Fortran system tracks related files by giving them the same first name with different extension names. The package handles these extensions automatically. If you wish to compile Exercise, you need type only these eight letters; the compiler automatically looks for EXER-CISE/FOR and calls the resulting code file EXERCISE/REL. The compiler does this using a DOS routine called \$PUTEXT. This routine was not documented on the Model I, and Radio Shack changed its location. It has been documented on

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the Model III. The routine begins at 4473 on the Model I and at 444B on the Model III. Consequently we change 7344 to 4B44 at location 6FF4 in EDIT/CMD, at locations 795C, 797F and 7999 in F80/CMD, and at locations 5D0C in L80/CMD.

This last change has a dramatic effect. F80 and L80 now work perfectly. At first glance, Edit seems to work too. But as soon as we try to reedit a file, the editor becomes very sick and refuses to reload the file.

#### The DCB

Now we come to the most annoving of all Model I to Model III changes. Radio Shack lengthened the DCB for disk files from 32 bytes to 50 bytes.

When you use a file, the file name is placed in an area of memory called the device control block or DCB, and the address of this block is given to a DOS routine called Open. The routine locates the file in the directory and replaces its name in the DCB with technical informa-

tion about it. While you manipulate the file, this DCB becomes a sort of scratchpad for the DOS. When you close the file, the name of the file is returned to the DCB.

The computer always reads or writes 256 bytes at a time. For example, when Patch changes a single byte of code, the computer actually reads in 256 bytes, changes that one byte, and then writes back all 256 bytes. The 256 byte memory area from which the computer reads and writes is called the buffer; the location of this buffer is given the system when a file is opened, and becomes part of the technical information in the DCB.

Many programmers arrange memory allocation so the file buffer immediately follows the DCB. How does this arrangement affect the change in the length of the DCB? Imagine that we are going to read from a file. First we place the name of the file in the DCB. This name takes less than 32 bytes and the rest of the DCB contains irrelevant information. Next, we open the file. The Model III scoops up the name and replaces it with technical information. This information is 18 bytes long (for a fairly short file) followed by 24 bytes of FF. Forty-two bytes in memory are changed. Since the Model I DCB is only 32 bytes long. an extra 10 bytes in the file buffer are filled with FF garbage.

This garbage is irrelevant because the file buffer contains nothing interesting yet. Next, we read the first record of the file. The beginning bytes of this record overwrite the last 10 bytes of FF in the technical information contained in the DCB. The technical information at the end of the DCB is information on file extents; you can change the last few bytes unless the file has a large number of extents.

Most programmers use the information in the file buffer only when the file is open. When the buffer is changed during the Open and Close routines, no harm is done. In summary, when the file buffer immediately follows the DCB in a Model I program, the program will probably work on the Model III.

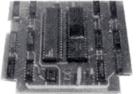
Programs such as F80 and L80 can cause trouble on a Model III. But this problem will only come up once or twice in a lifetime, when you try to write a file on a dirty disk and force a very large number of extents. If you are bothered by this possibility, feel free to change the DCBs in these two programs.

Not all programs are arranged in the above manner. Sometimes the DCB occurs in the middle of a program, followed immediately by other important code. It will be disastrous to use the disk during the operation of such programs. It turns out that Edit and muMATH fall in this class.

#### MuMATH

MuMATH is produced by the Software House in Hawaii. The program is written in Lisp and can perform algebraic manipulations. It expands polynomials, differentiates any reasonable function, and even integrates

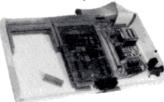
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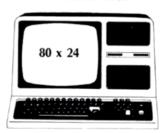
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using the method of substitution. The program happily handles very large numbers; for instance it can calculate 100! down to the last digit and then convert the result to hex. Some people claim that the very first computer program was one written by Ada Byron for Babbage's machine (but never run); the program computed Bernoulli numbers. Bernoulli numbers are very large rational numbers and the whole point is to know their numerators and denominators exactly; approximations are not interesting. MuMATH is the only system available for the TRS-80 which can run Ada's program without resorting to tricks.

When I first converted mu-MATH to the Model III. I was happy to find that it worked without change. Later I discovered a curious flaw. The authors of muMATH included a large demonstration file on the disk. This file asks muMATH a series of questions and mu-MATH stops to answer each question before reading further. Of course, muMATH can answer quite rapidly; you must freeze the screen if you wish to examine the answers. When I first tried this program on Model III, the questions and responses scrolled rapidly across the screen; I neglected to look at the answers because I had seen them all before. But soon a strange answer caught my eye as it floated off the screen and after freezing the display I discovered that muMATH had forgotten everything it once knew.

MuMATH repeats questions it cannot answer. If you ask it to integrate SIN(X), it replies -COS(X), but if you ask it to integrate SIN(X\*X\*X), it just replies INT(SIN(X\*X\*X),X). But in the demonstration program, muMATH replied 1+2 when asked to sum one and two.

The difficulty here is the DCB. In muMATH, it is hidden in the middle of the code. As soon as we try to read the demonstration disk, a small part of muMATH dies.

Unfortunately, muMATH uses up the complete 32K or 48K of computer memory and leaves no obvious spot to place a larger DCB. However, the DCB can be

located safely in a buffer area on page 42 of the DOS. There actually are two DCBs, one at 6F91 for reading and one at 6FE0 for writing. So to patch either version of muMATH, change 916F to 2542 at 63D4, 63DD and 64Bs. Also change E06F to 6042 at 6406, 640F, 642D and 6367.

#### Fixing the Edit DCB

Several techniques work to find the DCBs for Edit. Perhaps the easiest is to look for calls to the INIT routine at 4420 and the Open routine at 4424. Before calling these routines, the computer loads DE with the address of the DCB. Experiments like

Patch to change C05F to 00FF at 6FA6, 6FAE, 72DB, 72F8, 7307, 730D, 7318, 736E, 73A1, 772B, 7741, 7759, 7770, 7E58 and 7FB0. Then change C55F to 05FF at 7215. Finally change CB5F to 0BFF at 72CA.

Now test the result. Edit can read in and change a short program. But nasty surprises are ahead. When Edit reads a program longer than eight lines, it starts listing lines out of order, forgets pieces of lines, and ignores the end of the program entirely.

The new problem does not occur with DOS 1.1. Reaching into the bag of Radio Shack changes, When a program asks that a record be written to disk, the record is actually written into the 256 byte buffer we discussed earlier. But the buffer is written to disk only when it is full.

For instance, imagine that you are working with records of length 100 and you want to write four such records to disk. When you record 0, the operating system writes it into the buffer, but nothing goes to disk. The next record also moves only to the buffer, filling spots 100-199. The first part of record two moves to the buffer, filling spots 200-255, and then this buffer is written to disk. Next the buffer is cleared and the end of record two is written into its first 44 spots. Finally record number three is written from spot 44 to spot 143. The contents of the buffer, however, will not be written to disk until further logical records are written or you close the file.

The fictitious records of length LRL which compose a file are called "logical records." The actual 256 byte blocks of code on the disk are called "physical records." Thus in the above example, logical record number three is in physical record number one.

Now I can explain locations 8 and 12 in the DCB. In DOS 1.3. the information in these locations tells where to place the next byte to extend the file. If you closed the file described in the last paragraph after the four records were written, on the disk the file would consist of two records, each with 256 bytes of code. The first record would be called record zero and the second record one. In record one, only bytes 0-143 would be significant. When we reopen this file and fill the DCB with technical information, location 8 will contain 144 and location 12 will contain 1, because the next byte to be written would go to spot 144 in record one. Notice that the information in locations 8 and 12 is about physical records, not logical records.

An important special case occurs when a record ends at the boundary of a physical record. Suppose that a file contains exactly three physical records

## "The routine locates the file . . . and replaces its name in the DCB with technical information."

these show that the Edit program has DCBs at 5FA0 and 5FC0. Moreover, there is a temporary storage area for the contents of these blocks at 5FE0.

When the 5FA0 DCB is used, the computer overwrites the first part of the 5FC0 DCB. We are going to move this 5FC0 DCB to the address FF00; later on we will use other pieces of this page of memory as a patch space. If you have only 32K, you will have to change various pieces of the modification which follow (buy another 16K instead!).

Before using this area, we have to protect it from Edit by revising the reference to the top of memory. At 87DA we find the command LD HL,(4411). (The number 4411 was 4049 before we changed it a moment ago.) Change this command to LD HL, 0FEFFH. Use Patch to change 2A1144 to 21FFFE at 87DA.

Next find all references in the code to the number 5FC0. Unfortunately, many programs are savvy enough to use the technical information stored in the DCB; Edit is one of these. Consequently you also must find references to 5FC5 and 5FCB in the code.

Once you find these references, the final step is easy; use

we have just discovered the "end of file" revision.

#### The EOF

The DOS stores certain technical information in the DCB while a file is open. Call the address of the first byte in the DCB "location zero." Then locations 8 and 12 contain end of file information. To understand this information, you must know a little more about how DOS operates.

On the disk, a file consists of a series of "physical records", each 256 bytes long. These records are numbered record 0, record 1, record 2, ... The records may be scattered all over the disk, but the operating system handles all of that.

Sometimes it is inconvenient to deal with blocks of data 256 bytes long. The DOS allows users to write files with record lengths other than 256. For instance, Edit files have records of length 128. The length of the records in a file is called the "logical record length" or LRL.

However, this logical record length is fictitious. When records are written to the disk, they have length 256. The DOS converts the logical records in the programmer's mind into blocks of code exactly 256 bytes long.

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called record zero, record one and record two. Then location 8 will contain 0 and location 12 will contain 3 because the next byte to be added would be inserted at the start of physical record 3.

Locations 5 and 10 in the DCB contain similar information. Suppose that we are reading through a file. Each time we read a logical record, locations 5 and 10 are updated to point to the *next* byte to be read. For instance, if location 5 contains 52 and location 10 contains 3, then the *next* read command will start by reading spot 52 on physical record 3 of the file on disk.

All this is getting very complicated. Moreover, the story is different for DOS 1.1 and for the Model I. If a program uses the technical information in the DCB, it probably must be altered for DOS 1.3.

#### Fortran Record Number Calculations

In the Edit program two routines perform calculations on the above DCB information. Both routines calculate which 128 byte logical record was the last one read from disk. Let X equal the contents of location 5 and Y equal the contents of location 5. The required record number is  $2^*Y - 1$  if X = 0,  $2^*Y$  if  $0 < X \le 80$ , and  $2^*Y + 1$  if 80 < X. But the routines give a different answer:  $2^*Y - 2$  if  $0 < X \le 80$  and  $2^*Y - 1$  if X = 0 or 80 < X.

Incidentally, I found these routines by searching for the number 4442; the routine at 4442 positions a file to read the logical record number stored in BC. Once we find the error it is easy to fix. Starting at 721B, insert the code 78 20 04 FE 80 18 08 B7 20 03 1B 18 05 FE 81 38 01 13 (the old code here reads CA 2A 72 78 E6 7F C2 28 72 78 EE 80 47 1B 1B 78 87 D2 30 72 13). Then starting at 784D, insert the code 21 00 00 09 09 B7 20 03 2B 18 05 FE 81 38 01 23 00 00 (the old code reads E6 7F 7E 21 FE FF CA 58 78 EE 80 87 DA 5D 78 23 09 09).

This change improves the operation of Edit dramatically. Unfortunately, there are still two difficulties. When Edit attempts to read or write a file whose length is a multiple of 128 bytes, it fails. Writing such a file causes a catastrophic failure and reboot.

At 7F6C in Edit, a routine reads 128 bytes of code from the disk and stores them beginning at the location contained in HL. After reading, the routine checks to see if the record read from the disk was the last record in the file; if so, it puts 1A in memory immediately following the last byte of code from the file.

There is a tricky special case. If the last record in the file contains exactly 128 bytes, there is no spot in memory for 1A. The routine is supposed to wait until Read is called again, when it should place 1A at the first available memory spot.

As an interesting exercise, try to write such a routine using the technical information provided. You should know that when the Read routine reads a logical record and some of the bytes read are not in the file, it sets the zero

flag and places 1C in the accumulator. This happens even when only a few of the bytes read from disk do not belong to the file, but it does not happen if the file ends exactly at the boundary of the record. The required changes in code are easily implemented. Starting at 7F74, insert the code 28 11 FE 1C 37 C2 AC 67 3A A8 5F E6 7F 4F 06 00 09 36 1A D1 C1 E1 C9. (It will replace CA 7A 7F FE 1C 37 C2 AC 67 E5 21 AA 5F 5E 23 56 23 7E 23 66 6F CD F6.)

Edit cannot write files whose length is an even multiple of 128. I can solve the problem, but I do not know exactly why it came about.

The Write routine occurs at location 7917. After writing, the computer checks several memory locations. If conditions are exactly right, it tricks the stack by loading its last four locations with data from 5270-5277. For weeks I tried to understand this code; from the beginning, experiments disclosed that it operated only in the exceptional



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case causing trouble. It is easy to find the code's "mirror image": near 78E8 a routine saves the last four locations of the stack to 5270-5277. The basic problem on the Model III is that this "mirror image code" sometimes does not run before the section of code causing trouble

The solution I have invented runs like this. We modify the mirror image code so it sets a flag when it runs. Then we allow the dangerous code to run only if this flag has been previously set. The modified code is allowed to affect computer operations only during the writing of the main file (the index file causes no trouble).

Place these patches on the last page of memory. Change location 5200 from C3 B5 87 to C3 00 61; starting at 6100. replace the 00s with 22 20 61 21 30 61 11 40 FF 01 38 00 ED B0 2A 20 61 C3 B5 87. Then starting at 6130, replace the 00s with 21 5E FF 7E B7 36 00 21 1E 5F C2 3B 79 E1 C3 10 79 E5 21 5E FF 36 FF E1 E3 E1 E3 C3 F2 78 00 00 CD E0 7F 21 4A FF 36 C3 C9 F5 21 4A FF 36 C2 21 5E FF 36 00 E1 C3 02 77. Incidentally, 6100-6200 is Edit's write buffer; we are using it here temporarily to store patches which will reside up near FF00.

Connect these patches to the main program by changing 0277 to 69 FF at 62C3, CD E0 7F to CD 60 FF at 72FA, E3 E1 E3 to C3 51 FF at 78EF, and 21 1E 5F to C3 40 FF at 7938.

Edit, F80, and L80 now work! Top of Memory

The instruction manual explains that each Fortran program begins the same way: LD BC,\$\$L; JP \$INIT. It warns that \$INIT sets the stack pointer to the top of memory. How is this location determined? Since L80 creates each Fortran program, I hoped that L80 set the top of memory. No such luck; the program examines location 4049.

The \$INIT routine is contained in the library FORLIB/REL; we must find 4049 in this library and change it to 4411. Unfortunately the library is in code-not Z80 code, but Microsoft linker code. The manual explains that to save space in REL files, the Fortran system constructs these files as long chains of zeroes and ones: significant information is not aligned with eight bit boundaries. Therefore it is necessary to convert FORLIB/REL (which is a very large file) into a gigantic chain of zeroes and ones and then search through this chain for the bit pattern corresponding to 4049. (The coding method introduces an extra zero bit between each of these numbers.)

There might be hope for doing this by hand if \$INIT occurred near the start of the file (and I expected to find it there); actually \$INIT is hidden in the middle of things. Therefore I wrote an Assembly language program to search the file automatically.

Using the results of the search I can explain how to change the code. Use the F command of Debug to display the file FORLIB/REL. Use the plus key to leaf through this file until you come to a page which begins 8C 00 C9 11 50 E3 2A 00 ... Find the two bytes 49 20 starting at location 5C of this file. Use the M command to change these bytes to 11 22 and then push Enter. All modifications are now complete.

I did not actually search for 4049, though it would have been the logical thing to do. Instead I looked for the bit pattern corresponding to INIT. In advance, I knew that the \$INIT routine reads:

XOR A

(ADD1),A LD (ADD2),A LD

HL.NUMBER LD

(ADD3).HL LD

LD HL (4049H)

LD SP.HL

LD H.B LD L.C

(HL)

Once I found INIT, I began decoding the bit pattern by hand using the rules in a very obscure part of the manual. I gradually wrote down the information shown in Fig. 1.

#### A Problem for the Reader

After making all these changes Fortran programs work well on the Model III unless they write data to the disk. Files like FORT06/DAT created on disk are incomplete and out of order. I do not know how to fix this

problem. Can someone search for the routine in the FORLIB/ REL file that reads and writes data files and explain how to patch it?

#### **Summary of Required Changes**

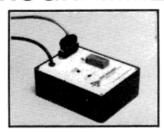
Tables 1-4 list the changes you must make to muMATH, Edit, F80, and FORLIB/REL for the Model III. In each case, I list the starting location, old code, and new code. Use the Patch command to make these changes.

Consider, for example, the first change. It asks that location 63D4 of muMATH be changed from 916F to 2542. To do this, type PATCH MATH48/CMD (ADD = 63D4, FIND = 916F, CHG = 2542), and press Enter. The disk will turn on briefly and then the computer will print "Patch Made". If it ever prints "String NOT Found", you made a typing mistake and you should issue the command again. Replace MATH48/CMD by the correct program name in other cases: MATH32/CMD, EDIT/CMD, F80/ CMD, or L80/CMD.

Finally, you must modify FORLIB/ REL in a different manner. Run Debug and issue the command F. The computer will ask for a filespec; type FORLIB/REL and press Enter. The disk will run and the screen will show a display of numbers. Each time you press the plus key, the disk will run and the display will change. Keep pressing plus until you see 8C 00 C9 11 50 E3 2A . . . along the top line of the display. Then press M. Immediately a small square will appear at the top left of the screen. Move the square down to line 5 using the down arrow key, and then over 12 spaces using the right arrow key until it lands on top of 49. Type 11 22; the two entries 49 20 will change to 11 22. Now press Enter. The disk will turn on briefly. Press the Break key twice and you will be back in DOS.

Richard Koch is Associate Professor of Mathematics at the University of Oregon.

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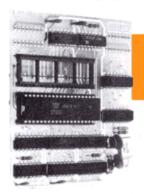
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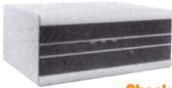
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### Find a solution to your waiting line problems with the TRS-80.

## Queue Up!

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Waiting lines are everywhere in modern society. Nearly all services available today involve waiting. The cost of providing instant service is usually high, and is only justified in a few rare situations. There is normally a tradeoff between cost of service and cost of waiting. With limited servers, a line develops with demand for the service. Typically, there is a cost of providing

a waiting area to accommodate the waiting customers (or jobs). There is a penalty for customers who leave the line when waiting seems too long.

Most firms or institutions which provide a service spend some time in waiting line analysis aided by a computer program. Following is a TRS-80 program for analyzing simple waiting line problems. While the analysis is limited to fairly basic models, the level achieved is surprising.

#### **Definitions**

This program is limited to Poisson waiting lines, relatively

unconstrained, random arrivals and departures. The Poisson classification is a mathematical characterization of a truly random arrival and departure waiting line discipline. In most cases, the Poisson behavior may be assumed: even in those cases which are not theoretically correct, the computer program provides useful rough results. The formal conditions for Poisson waiting lines are described in most operations research textbooks; the readers who wish to rigorously classify their waiting line models should consult such a text. In any analysis effort, it is the analyst's responsibility to validate results for the system under study.

The Kendall notation is used in the following descriptions of examples of waiting line models, to describe the model parameters. This convenient shorthand notation has the form (M/M/c)-(GD/K/N).

The Key Box

Basic Level II Model I 16K RAM These descriptors completely define the parameters of a Poisson waiting line. The first two letters (M) signify Poisson arrival and departure rates, while the c designates the number of servers in the system. The last three letters describe the properties of the calling customers. GD (general discipline) implies a first-come first-served scheme. If other service schemes are in use, this model will not work.

K and N specify available waiting space and numbers of calling customers respectively. As an example, consider the notation (M/M/1)-(GD /9999/9999) indicates that customers arrive and are serviced according to the Poisson model (M/M). The customers file through one server (c = 1) in a first-come first-served fashion (GD). There is unlimited space for waiting (9999) and the calling population is theoretically unlimited (9999). This is the classical (M/M/1) waiting line model where both arrivals and departures follow a random pattern.

The computer analysis of this model is in Fig. 1. This printout is in response to the query "Input arr. rate, svc. rate, no. servers, waiting spaces, customer

#### (M/M/ 1 )-(GD/ 9999 / 9999 )

ARR. RATE = 20 SVC. RATE = 30 EFF. ARR. RATE = 20 TRAFFIC INTENSITY = .666667

AVG. TIME IN SYS. = .1 AVG. NO. CUST. IN SYS. = 2 AVG. TIME IN LINE = .0666667 AVG. NO. CUST. IN LINE = 1.33333

LIKELIHOOD OF EXACTLY N (FOR N = 0 TO 25 ) CUSTOMERS IN THE SYSTEM, 333333 .222222 .148148 .0987654 .0658436 .0438958 .0292638 .0195092 .010062 8.67077E-03 5.78051E-03 3.85367E-03 2.56912E-03 1.71274E-03 1.14183E-03 7.6122E-04 3.3832E-04 2.25547E-04 1.50364E-04 1.00243E-04 6.68286E-05 4.45524E-05 2.97016E-05 1.98011E-05 1.32007E-05

Fig. 1

#### (M/M/ 1 )-(GD/ 9999 / 9999 )

ARR. RATE = 25 SVC. RATE = 30 EFF. ARR. RATE = 25 TRAFFIC INTENSITY = .833333

AVG. TIME IN SYS. = .2 AVG. NO. CUST. IN SYS. = 5 AVG. TIME IN LINE = .166667 AVG. NO. CUST. IN LINE = 4.16667

LIKELIHOOD OF EXACTLY N (FOR N = 0 TO 53 ) CUSTOMERS IN THE SYSTEM, .166667 .138889 .115741 .0964506 .0803755 .0669796 .0558163 .0465136 .0387613 .0323011 .0269176 .0224313 .0186928 .0155773 .0129811 .0108176 9.01465E-03 7.51221E-03 6.26017E-03 5.21681E-03 4.34734E-03 3.62278E-03 3.01899E-03 2.51582E-03 2.09652E-03

Note Output terminated to conserve space

Fig. 2

(M/M/ 1 )-(GD/ 10 / 9999 )

ARR. RATE = 20 SVC. RATE = 30 EFF. ARR. RATE = 19.883 TRAFFIC INTENSITY = .666667

AVG. TIME IN SYS. = .0941175 AVG. NO. CUST. IN SYS. = 1.87134 AVG. TIME IN LINE = .0607841 AVG. NO. CUST. IN LINE = 1.20857

LIKELIHOOD OF EXACTLY N (FOR N = 0 TO 10 ) CUSTOMERS IN THE SYSTEM, .337232 .224821 .149881 .0999206 .0666138 .0444092 .0296061 .0197374 .0131583 8.77218E-03 5.84812E-03

Fig. 3

population." For this example, the input was 20,30,1,9999,9999 where the arrival rate (20 per hour) and the departure rate (30 per hour) were arbitrarily chosen. The printout echoes this input data. In an actual problem, these rates must be determined by studying the system and tabulating actual arrival and departure data.

The first analytical results are the effective arrival rate and the traffic intensity. Effective arrival rate is only of interest in problems where the calling population is not unlimited. Traffic intensity is the ratio of arrival rate over departure rate, providing an estimate of how busy the server is in the system. For an unlimited system, this value must be less than one, or the waiting line will grow infinitely. If the intens-

ity exceeds one, arrivals occur faster than they can be served.

The next two output values concern the average time customers wait in the system and in the line. In this example, the server is quite prompt and customers only spend six minutes in the system, four minutes of which are in line. The service rate is 30 customers per hour, or two minutes per customer, and six minus two equals four.

The service speed is further illustrated by the line statistics in the printout. There is an average of 1.3 persons in line or a total of two persons in the system at any one time. These results are ideal for the customer, but the server is not very busy.

The last section of data indicates the probability of exactly N customers on the system, beginning with zero, after the system reaches steady state. These values are computed by the program until the probabilities become less than 0.00001 (an arbitrary limit which can be changed in the program). In Fig. 1. N varies from zero to 25 before the probability values become insignificantly small. The analyst concludes that the likelihood of no one in the system (N = 0) is 0.33, or that the server is idle 33 percent of the time. The possibility of more than two persons in the system rapidly falls off, indicating the expected "decaying exponential" pattern typical in Poisson waiting line problems.

#### Examples

The ideas in the previous section can be illustrated with a few examples of simple waiting line models. The first example is a modification of the model in the previous section. Because the server was idle a considerable amount of the time, activity is stimulated and more customers assigned to that server. The results of an increased arrival rate are shown in Fig. 2.

The traffic intensity increases, the server is busy 84 percent of the time, and there is a likelihood of up to 53 customers in the system. If waiting area becomes a problem, the analyst can add probability values up to an estimate of system saturation. If 10 persons in the system are a problem, the analyst adds probabilities for nine persons or less, yielding 0.84. The probability of 10 or more is 0.16 (1 minus 0.84 equals 0.16). Use this type of estimate to evaluate the need for more waiting area.

```
10 CLS:M=200:DIM P(200)
20 PRINT"INPUT ARR. RATE, SVC.RATE, NO.SERVERS, WAITING SPACES, CUSTOMER POPULATION"
25 INPUT XL,MA,C,MA,XX
50 CLS:IT=1:NC=C:M=DN:K=XK:RH=XL/XM:EL=XL
80 LPRINT TAB(15)"(M/M/";NC:")-(GD/";N:"/";K;")"
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                620 NEXT I

630 |= NN+1

540 QL=0

650 GOTO 990

660 IF K<9999 GOTO 880

670 IF RC >=1 AMD N=9999 THEN1090
                            IF K(9999 AND K > M AND N >M GOTO1090
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    680 P(1)=RH
90 IF K:9999 AND K
95 IF M:N THEN 110
97 IF N:N THEN 120
100 NN=N:GOTO 130
110 IF M:K THEN 12
115 NN=M:GOTO 130
120 NN=K
130 RC=RH/C
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    690 FOR 1= 2 TO NC
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                690 FOR I = 2 TO NC
700 X=1
710 P(1)=P(1-1)=RH/X
720 PZ=PZ=P(1-1)
730 NEXT I
740 X=P(NC)/(1-RC)
750 [F NC9999 THEN X=X*(1-RC:(N-NC+1))
760 PZ=PZ-X
770 PZ=1/PZ
780 FOR I=1 TO NC
790 P(1)=PZ=P(1)
800 NEXT I
810 FOR I=NC TO NN
820 P(1)=P(1-1)=RC
830 [F P(1)=P(1-1)=RC
830 [F P(1)=P(1-1)=RC
831 [F IT-0 THEN 950
832 [F IT-0 THEN 950
834 [F IT <00 THEN 850
840 IT = 0
850 MEXT I
860 I=NN+1
860 I=NN+1
860 I=NN+1
870 GOTO 960
880 P(1)=XK-RH
882 FOR I=2 TO NC
883 X=I
882 FOR I=2 TO NC
883 X=I
885 V=K-1=1
130 RC=RH/C
140 P2-1
150 FOR i=1 TO NN
153 P(1)=0
155 NEXT i
160 IF NC > 1 THEN 540
170 IF K*999 THEN 290
180 IF RC >=1 AMD N= 9999 THEN1090
190 P2**PZ-RH
200 IF NC**9999 THEN PZ=PZ/(1-RH:(N*1))
210 P(1)=PZ**RH
220 FOR I=2 TO NN
210 P(1)=PZ=RH
220 FOR I=2 TO NN
230 P(I)=P(I-1)=RH
240 IF P(I)>=1E-5 THEN 250
242 IF IT=0 THEN 960
250 IT=0
250 IT=0
250 (T=0)
250 (T=0)
250 (N=0)
250 (N
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  882 FOR [=2 TO NC
883 X=|
885 Y=K-[+1]
887 P(|)=P([-1])=RH+Y/X
889 P(2=P2-P(-1))
890 P(2=P2-P(-1))
892 MEXT |
992 MEXT |
993 P(1)=P(-1)=RC=X
930 P(1)=P(1-1)=RC=X
930 P(1)=P(1-1)=RC=X
930 P(1)=P(1-1)=RC=X
940 MEXT |
950 MEXT |
950 MEXT |
960 MEXT |
970 M
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    980 EL=XL+(1-P(NN))
990 SL=QL+EL/XM
1000 WS=SL/EL
1010 MQ=QL/EL
1020 MX=I-1
      390 IT =0
400 NEXT |
410 |-NN+1
420 LL=|-1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         1030 LPRINT "ARR.RATE=";XL;TAB(30)"EFF.ARR. RATE=";EL
1035 LPRINT "SVC. RATE=";XM;TAB(30)"TRAFFIC INTENSITY=";RH
        420 LL=1-1
430 QL=0
440 FOR J=NC TO LL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       1035 LPRINT "SVC. RATE="; XW; YAB(30)"TRAFFIC INTENSITY="; RH
1037 LPRINT "AVG, TIME IN SYS.="; WS; TAB(35)"AVG, TIME IN LINE="; WD
1045 LPRINT "AVG, NO, CUST. IN SYS.="; SL; TAB(35)"AVG, NO. CUST. IN LINE="; QL
1047 LPRINT
1050 LPRINT "LIKELIHOOO OF EXACTLY N (FOR N=0 TO"; PX; ") CUSTOMERS IN THE SYSTEM,"
1055 LPRINT PZ;
      450 X=J-NC
460 QL=OL+X*P(J)
465 NEXT J
           170 R=C+PZ
480 FOR J= 1 TO NC
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    1055 K-PRINT PZ;

1059 K-0

1060 FOR I=1 TO MX

1061 K-K+1

1070 LPRINT P(I);

1071 IF K-6 GOTO 1075

1072 GOTO 1080

1075 LPRINT CHRS(9):K-0
  480 FOR J= 1 TO NC

490 X=NC-J

500 R=R*X=P(J)

510 NEXT J

520 EL=XM=+(C-R)

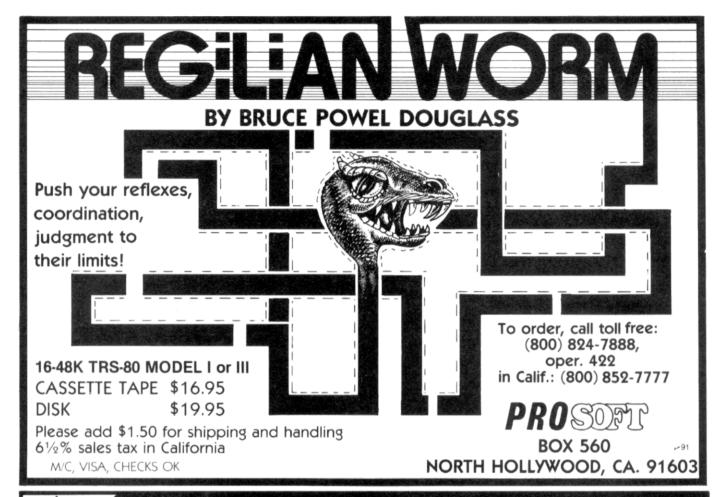
530 GOTO 990

540 IF NCC 9999 GOTO 660

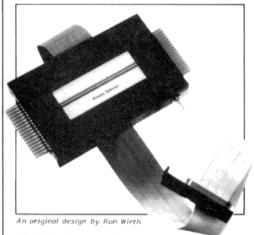
550 PZ=EXP(-RH)

560 P(1)=PZ=RH

570 FOR J=2 TO NH
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           1080 NEXT I
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       1081 LPRINT:LPRINT:LPRINT
1085 GOTO 20
1090 PRINT "ARR. RATE=";XL;TAB(30) " EFF. ARR. RATE=";EL
1091 PRINT "SVC. RATE=";D+;TAB(30) "TRAFFIC INTENSITY=";PH
1092 PRINT:PRINT "INVALID CATA"
1110 PRINT
1110 GOTO 20
1220 PAID
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         1081 LPRINT: LPRINT: LPRINT
      570 FOR 1=2 TO NN
                                     P(1)=P(1-1)=RH/X
                                     IF P(I)>=1E-5 THEN 610
IF IT=0 THEN 640
IF IT<>0 THEN 620
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    Program Listing
```



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The results are identical if the service rate is reduced instead of increasing the arrival rate (by using a less skilled server or by adding tasks to the service function). For example, if the arrival rate remains at 20 per hour as in Fig. 1, and the service rate is reduced to 24 per hour, the traffic intensity will be 0.833—exactly as shown in Fig. 2. The remaining results, as well, are identical.

Fig. 3 shows statistics if only 10 customers can wait. The effective arrival rate reflects the fact that customers are turned away or leave if waiting area is not available. The results in Fig. 3 are close to the results in Fig. 1; the likelihood of ten or more persons calculated previously was quite small (0.16). The analyst would conclude that planning a waiting area for 10 customers is quite conservative, but accommodates nearly all likely conditions.

Fig. 4 displays results for a ser-

vice rate of only 10 customers per hour. The traffic intensity exceeds one, only possible in a waiting line model where waiting area or calling population is limited. Customers in this system spend a far greater amount of time waiting and there is almost no chance of finding the server idle. The effective arrival rate indicates a high number of customers turned away due to inadequate waiting area.

Consider the case where the calling population is limited. The results in Fig. 5 indicate that with a calling population of 100, the service is so slow customers must nearly always wait. Continuing this analysis with reduced values for the calling population does not change the results significantly. This lack of change is due to the high arrival rate even with a small calling population.

A final example illustrates the case of added servers. Using the data in Fig. 5, but adding a server,

yields the data in Fig. 6. There is a reduction in waiting time, but the line remains long. Clearly an improvement in service time is necessary to produce meaningful change in the results.

Further investigation is limited only by the analyst's imagination. An interesting model is the (M/M/N)-(GD/N/N) case where there is a server for each customer, as in a self-service facility.

Other analyses may be found in any basic operations research text.

The text by Saaty (see References) is a classical treatment of the theory of waiting lines. ■

#### References

Saaty, T., Elements of Queuing Theory, New York: McGraw-Hill, 1961

Shamblin, J.E. and G.T. Stevens, Jr., Operations Research, a Fundamental Approach, New York: McGraw-Hill, 1974.

Taha, H.A., Operations Research, an Introduction, New York: MacMillan, 1971.

(M/M/ 1 )-(GD/ 10 / 100 )

ARR. RATE = 20 SVC. RATE = 10 EFF. ARR. RATE = 10 TRAFFIC INTENSITY = 2

AVG. TIME IN SYS. = .999448 AVG. NO. CUST. IN SYS. = 9.99448 AVG. TIME IN LINE = .899448 AVG. NO. CUST. IN LINE = 8.99448

LIKELIHOOD OF EXACTLY N (FOR N = 0 TO 10 ) CUSTOMERS IN THE SYSTEM, 1.54611E-23 3.09222E-21 6.12259E-19 1.20003E-16 2.32805E-14 4.46986E-12 8.49273E-10 1.59663E-07 2.96974E-05 5.46432E-03.994506

Fig. 5

(M/M/ 1 )-(GD/ 10 / 9999 )

ARR. RATE = 20 SVC. RATE = 10 EFF. ARR. RATE = 9.99512 TRAFFIC INTENSITY = 2

AVG. TIME IN SYS. = .900978 AVG. NO. CUST. IN SYS. = 9.00537 AVG. TIME IN LINE = .800978 AVG. NO. CUST. IN LINE = 8.00586

LIKELIHOOD OF EXACTLY N (FOR N = 0 TO 10 ) CUSTOMERS IN THE SYSTEM, 4.8852E-04 9.7704E-04 1.95408E-03 3.90816E-03 7.81632E-03 .0156326 .0312653 .0625305 .125061 .250122 .500244

Fig. 4

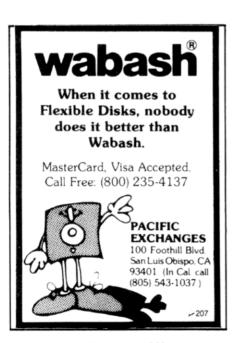
(M/M/2)-(GD/10/100)

ARR. RATE = 20 SVC. RATE = 10 EFF. ARR. RATE = 20 TRAFFIC INTENSITY = 2

AVG. TIME IN SYS. = .499445 AVG. NO. CUST. IN SYS. = 9.98889 AVG. TIME IN LINE = .399445 AVG. NO. CUST. IN LINE = 7.98889

LIKELIHOOD OF EXACTLY N (FOR N = 0 TO 10 ) CUSTOMERS IN THE SYSTEM, 7.87235E-21 1.57447E-18 1.55872E-16 1.52755E-14 1.48172E-12 1.42245E-10 1.35133E-08 1.27025E-06 1.18133E-04 .0108683 .989012

Fig. 6



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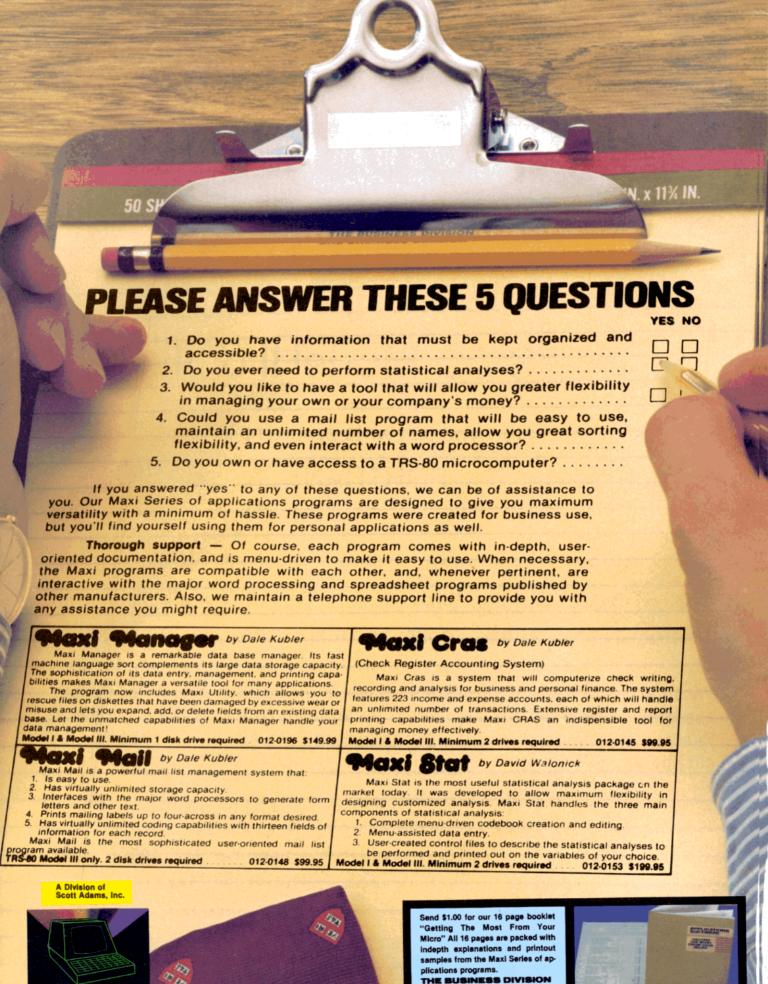












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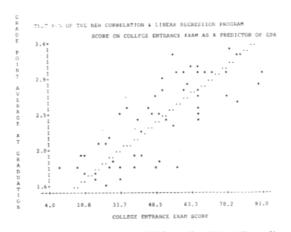
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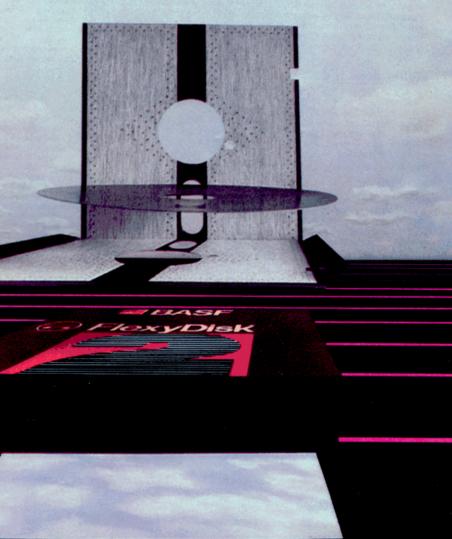
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#### A marathon for mice.

### Maze XIX

Gary Teter 6692 Shay Lane Paradise, CA 95969

The object of Maze XIX is to guide a moving dot through the maze and back as quickly as possible. The arrow keys direct the dot. Running into the wall adds 20 points to your score.

If you need to leave the computer while the game is running, press Clear to halt the game. To continue press any arrow key. To end the game, hold down the Spacebar.

#### The Program

The program is fairly straightforward. The sound routine, by Leo Christopherson (80-US, May/June 1980), is POKEd into S\$ in line 950.

I included a checksum routine, making it almost impossible to bomb the program with a typo in a data statement. Line 930 checks the length of S\$ to make sure it is 74. The only way I can think of to bomb the program is to exchange a couple of numbers in the data statements (please do not take that as a challenge!).

All constants in the dot-move routine (lines 40 and 50) are defined as variables. This makes the game run faster because variables are placed into a table. Those at the top (the

ones defined first) are referenced faster than those at the bottom (and also faster than constants). For this reason I defined the variables used in lines 40 and 50 at line 910.

The program should run on other DOSes but I have not tested it on any. For all you program modifiers, Table 1 is a listing of each section, along with what each part does.

Gary is a 15-year-old high school junior. He is a founding member (and presently general manager) of the Ficticious GLM Corporation.

ave you ever wondered how a mouse running a maze feels? Now you have a chance to find out: Put on your mouse ears and get ready to play Maze XIX!

#### To Play

After entering the program in the listing, hook up an amplifier (or a modified tape recorder) for sound. After the Hall of Fame display press Enter to begin the game.

#### The Key Box

Basic Level II Model I 16K to 48K RAM TRSDOS 2.3

#### Program Listing

- 10 REM Maze XIX by Gary M. Teter Copyright (c)1918 by the 20 REM GLM corporation (no rights reserved, free to all) 30 GOTTMS (c)
- 30 GOTOGGO 40 S=S-1:IFX>63ANDY<7THENF1=-1ELSEIFX<63ANDY<7ANDF1THEN9@ELSEC=PEEK(P):IFCA NDL,E=-3:F=@ELSEIFCANDR,E=3:F=@ELSEIFCANDU,F=-1:E=@ELSEIFCANDD,F=1:E=@ELSEI FCANDGGOTO8@ELSEIFCANDHTHEN11@
- 50 X=X+E:Y=Y+F:IPPOINT(X,Y)THEN60ELSERESET(X-E,Y-F):SET(X,Y):GOTO40
  60 S=S+20:W=W+1:E=-E:F=-F:X=X+E:Y=Y+F:POKES0+6,1:POKES0+16,RKD(50)+100
- 60 S=S+20:M=W+1:E=-E:F=-F:X=X+E:Y=Y+F:POKES0+6,1:POKES0+16,RND(50)+1
  70 O=USR(0):GOTO40
  80 C=PERK(P).FCANDUORCANDUORCANDUORCANDUORCANDUORCANDUORCANDUORCANDUORCANDUORCANDUORCANDUORCANDUORCANDUORCANDUORCANDUORCANDUORCANDU
- 88 C=PEEK(P):IFCANDUORCANDRORCANDLORCANDDTHEN40ELSE80
  98 CLS:GOSUB670:FRINTCHR\$(23):PRINT:FRINT:FORIX=1TO10:IFS<S(IX),GOSUB710:GO
  TO110ELSENEXT

100 PRINT"Your score was "SCHR\$(8)".":PRINT"You crashed "W"time";:IFW<>1,PRIN

Listing continues

### 10-20 Credit given where credit is due 30 Call initialize variables routine

Level II 40-50 Dot move routine, and check for wall hit 60-70 Change direction and make bounce sound 80 Delay until arrow key pressed 48K RAM 90-160 Ask for another game

#### Delay until arrow key pressed Ask for another game 170 Separate the subs from the program 180 Show titles and make starting noise 190-210 Draw maze frame 220-280 Create the openings 290-310 Reset variables, make sound and start game 320 Hole routine; choose start of opening 330-360 Check for conflicts-force player to turn 370-380 Make the hole and return

390-480 Display "Play Maze XIX" titles 490-500 Loop until Enter key is pressed 510-530 Draw the maze frame

540-560 Open the paths
580-640 Blinking cursor routine. Returns Z\$
650 Center title and print slowly

650 Center title and print slowly 660-670 Sound routines

9999

710-830 Set high score, enter initials
840-1050 Initialize all variables

Save updates on disk

Table 1

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SFINKS

238 GUSUBJ28 248 NEXT 258 POKE16351,176:POKE16287,143:POKE16352,176:POKE16287,143:POKE16288,141 268 A-64:B=125:Y=4:FORZ=14TO27 278 Y=Y=3:GOSUB328 288 NEXT 288 X=3:Y=3:E=3:F=8:F1=8 388 POKES8+6,2:POKES8+34,4:O=USR(6) 318 GOTO48
328 IPA-STHENPL=RND(49)+2ELSEPL=RND(47)+66
338 IPPL=PVTHEN328ELSEIPPL+8=PV+8THEN328ELSEIFPL<PVANDPL+9>PVTHEN328 336 IPPL=PVTHEN328ELSEIPPL+8=PV-8THEN328ELSEIPPL>PV+8THEN368
346 IPPL>PVANDPL+8</br>
357 IPPL>PVTHEN328
358 IPPL>PVTHEN328
368 IPPL+8>B-3THEN328
376 PV-PL:FORX-PLTOPL+8STEP2:RESET(X+1,Y):RESET(X,Y):NEXT:PL(Z)=PL
369 RETURN
390 GOTO688
496 CLS:P\$="Play":PRINTCHR\$(23):GOSUB658
418 IPINKEY\$=CHR\$(13)\*THEN588
428 P\$="Maze XIX":PRINT:GOSUB658
429 P\$="Maze XIX":PRINT:GOSUB658 426 PS="Maze XIX":PRINT:GOSUB656
436 IFINKEYS=CHRS(13) THEN588
448 PS="\* 1 quarter - 1 play \*":PRINT:PRINT:GOSUB658
458 IFINKEYS=CHRS(13) THEN588
468 PS="\* 2 quarters - 3 plays \*":PRINT:GOSUB658
478 IFINKEYS=CHRS(13) THEN588
488 PRINT:PRINT:PS="Press -ENTER- to begin":PRINT:PRINT:PRINT:GOSUB658
489 PRINT:PRINT:PS="Press -ENTER- to begin":PRINT:PRINT:PRINT:GOSUB658
489 PRINT:PRINT:PS="Press -ENTER- to begin":PRINT:PRINT:PRINT:GOSUB658
489 PRINT:PRINT:PS="Press -ENTER- to begin":PRINT:PRINT:PRINT:PRINT:GOSUB658
489 PRINT:PRINT:PS="Press -ENTER- to begin":PRINT: 23)ORX=32ORX=8ORX=13THENPRINTXAS;:RETURN
618 GOTO 596
628 IX=IX=1:PRINTXAS;:IFIX>18THEN586
638 IX=IX=1:PRINTXAS;:IFIX>18THEN586
638 IX=INXEYS:IFIX<>\*\*" = Z=ASC(2S):IF(X>64ANDZ<91)OR(Z>47ANDZ<58)OR(X>96ANDZ<1
23)ORX=32ORX=80RX=13THENRETURN
648 GOTO 628
658 PRINTTAB(16-LEN(PS)/2);:FORK=1TOLEN(PS):PRINTNIDS(PS,K,1);:FORTD=1TO45: 648 COTO 628
658 PRINTTAB(16-LEN(PS)/2);:PORK=ITOLEN(PS):PRINTNIDS(PS,K,1);:FORTD=ITO45:
NEXT:NEXT:PRINT:NETURN
668 PORES8+6,2:POKES8+34,4:O-USR(0):RETURN
678 PORES8+6,2:POKES8+34,4:O-USR(0):RETURN
680 CLS:PRINTCHRS(23);:PRINTTAB(4)"The Naze XIX Hall Of Fame"
690 PRINT:PORIX-ITO9:PRINTTAB(9)"LICHRS(8)". ";S(IX):TAB(19)"- "SS(IX):NEX
T:PRINTTAB(8);IX;CHRS(8)". "S(IX);TAB(19)"- "SS(IX):PRINT:PRINTTAB(4)"COPYT
19ht (c)1918 by the ":PRINTTAB(2)"G L N C O r p O r a t i O n"
788 IFINKEYS-CHRS(13) THERRETURNELSEHJ-HJ-1:IFHJ>275,RJ=0:GOTO488ELSE788
718 PRINTES96,TAB(3)"YOU have set a high score."
728 PRINTTAB(3)"Please enter your initials"
738 FORIS-9TOIXSTEP-1:S(IS+1)=S(IS):SS(IS+1)=SS(IS):NEXT:S(IX)=S:IT=IX
748 PRINTES,""."PRINTTAB(4)"The Maxe XIX Hall Of Pame":PRINT:PORIY-1TO9:PRI
NTTAB(9);IY;CHRS(8)". ";S(IY);TAB(19)"- "S\$(IY):NEXT:PRINTTAB(8);IY;CHRS(8)".
758 PRINTES4"+1:06,STRINGS(3,132);:PRINTE64\*IT+106,"",
768 GOSUBS80:IF(2>64ANDZ(91)ORZ-32OR(2>96ANDZ<123)THEN790ELSEIFZ=STHENPRINT
778 PRINTES;:HS-8-15
780 GOSUBS80:IF(2>64ANDZ(91)ORZ-32OR(2>96ANDZ<123)THEN790ELSEIFZ=STHENPRINT
CHRS(8);:HS-LEFTS(HS,2):GOTO780ELSE808
810 PRINTES;:HS-8-15
820 GOSUBS80:IF(2>64ANDZ(91)ORZ-32OR(2>96ANDZ<123)THEN810ELSEIFZ=STHENPRINT
CHRS(8);:HS-LEFTS(HS,2):GOTO780ELSE808
810 PRINTES;:HS-8-15-12
822 GOSUBS80:IF(2>64ANDZ(91)ORZ-32OR(2)96ANDZ<123)THEN810ELSEIFZ=STHENPRINT
CHRS(8);:HS-LEFTS(HS,2):GOTO780ELSE808
812 PRINTES;:HS-8-15-12
8238 SS(IT)=HS:PRINTE768,CHRS(31);:IFLEN(HS)<>>3THENHS="::GOTO750ELSERETURN 26
836 S\$[IT]=HS:PRINT&768,CHR\$[31];:IFLEN[HS]<>3THENHS="":GOTO758ELSERETURN
848 DATA 33,1,2,14,255,62,2,254,2,48,21,254,3,48,38,17
858 DATA 13,188,237,97,67,16,254,237,185,67,16,254,21
868 DATA 32,243,243,17,1,5,123,237,97,71,16,254,237,185
878 DATA 71,16,254,68,32,243,21,32,239,281,17,188,2,123
888 DATA 237,97,71,16,254,237,185,71,16,254,61,32,243,21
899 DATA 32,239,281,34
998 CLERASS8:DEFINTA-2:RANDOM:DIMPL(48)
918 S=8:K=5:Y=3:C=8:P=15188:E=8:F=8:L=32:R=64:U=8:D=16:G=2:H=128:F1=8
928 SS="12345678981234567889812345678981234567898123456789812345678981234567898123456789

8991214"
938 IPLEN(S\$)<>74THENPRINT"\* Length of S\$ in line 948 is not correct - should be 74 "":STOP
948 SI=PEEK(VARPTR(S\$)+1):S2=PEEK(VARPTR(S\$)+2):S8=S2\*256+S1
958 RESTORE:FORN=6TO73:READD1:POKES8+N,D1:C=C+D1:NEXT:IFC<>7759THENPRINT"\*
Checksum error - check data in lines 858 to 988 "":STOP
968 IPPEEX(16396)=Z81POKE16526,S1:POKE16527,S2ELSEDEFUSR8=S8:CHD"T"
978 A5=CHR\$(191) +CHR\$(149):BS=AS+STRING\$(29,32)+AS+STRING\$(29,32)+CHR\$(178)
+CHR\$(191)

T-INTS(171)
988 CS=CURS(191)+CHRS(151)
998 XS=CS+STRINGS(29,131)+CS+STRINGS(29,131)+CHRS(171)+CHRS(191)
1888 YS=CHRS(191)+CHRS(181)+STRINGS(29,176)+CHRS(191)+CHRS(181)+STRINGS(29,176)+CHRS(181)+CHRS(181)+STRINGS(29,176)+CHRS(181)+CHRS(181)+STRINGS(29,176)+CHRS(181)+

176) + CHR\$ (186)
1018 2A\$=CHR\$ (191) + CHR\$ (157)
1028 21\$=ZA\$+STRING\$ (29,148) + ZA\$+STRING\$ (29,148) + CHR\$ (174) + CHR\$ (191)
1038 FORIX=1TO18:S\$ (IX) = STRING\$ (3,132):S (IX) = 9999:NEXT
1858 END

9999 PRINT"Saving updates.":PRINT"MAZE19/BAS":SAVE"MAZE19/BAS":END

T"s."ELSEPRINT"."

118 IPCANDHCLS:PRINTCHR\$(23)

129 PRINT:PRINT:S=":W=0:PRINT"Play again? ";

136 GOSUBS58:IPI\$="N"ORI\$="1"HENPRINTES;:ELSEGOTO136

149 IPI\$="Y"ORI\$="y"THENPRINTES;:ELSEGOTO136

159 PRINT:PRINT'Use the same maze? ";

169 GOSUB589:IPI\$="y"ORI\$="y"THENPRINTES;:GOSUB518:GOSUB298:GOTO46ELSEIFI\$="N"ORI\$="""THENPRINTES;:GOSUB58:GOSUB298:GOTO46ELSEIFI\$="N"ORI\$="""THENPRINTES;:GOSUB198:GOTO46ELSEIFI\$="N"ORI\$=""""THENPRINTES;:GOSUB198:GOTO46ELSEI68

176 END
188 GOSUB688:GOSUB678:PORIY=1TO18:GOSUB668:NEXT
198 CLS:PRINT864,BS;
288 PORIX=2T014:PRINT81X\*64,215::NEXT
218 PRINT87,X5::PRINT8968,Y5::POKE16383,191
228 A=8:B=63:Y=4:FOR2=1T013:Y=Y+3
238 GOSUB328

## Open Cartridge Surgery

Bill Grout 380 Channing Way #171 San Rafael, CA 94903

have a Daisy Wheel Printer II from Radio Shack. It's a wonderful machine, but the ribbon cartridges are longer and flatter than those for other machines, so you can't substitute any other cartridge. These cartridges seem too valuable to throw out when the ribbon runs dry after only four or five hours of printing.

If you have a printer that uses expensive and hard-to-find ribbon cartridges, it is possible to reload them with the ribbons from cheaper cartridges.

First, check the ribbon width of your cartridge. (In my cartridge it was ¼ inch wide.) Once you know the size and kind of ribbon you want, go to the office supply store. I bought a smaller Qume cartridge with the right ribbon, though different in shape from my cartridge. If you

are selective you may be able to find a cartridge for dollars less.

It would be easier to buy a spool of ribbon to put into the old cartridge, but I found none available. So I was forced to buy a foreign cartridge and then transfer the ribbon to my old cartridge.

Take the new and old cartridges into the kitchen. On your way, get a table knife and a roll of Scotch tape.

Carefully open your old ribbon cartridge. Remove the rubber band from the knob and axle; the rubber band turns a spool that winds up the used ribbon. Hold the cartridge in your hand and find the seam where the two halves of the plastic case are snapped together. They aren't glued, so slide the knife blade into the seam and work your way around the case until you can lift the top half off.

Examine the inside of the cartridge. (See Fig. 1.) Find the spool of used ribbon on the right. Running back from the spool, the ribbon threads through two gears, around a post, and out the front of the cartridge. Notice how the ribbon threads around the different gears and rollers so you can replace the ribbon correctly. Tracing the ribbon back, you'll see that it goes into the other arm of the cartridge, around a plastic guide with a piece of sponge and a spring attached to it, and then around two rollers in an S fashion. Finally it goes to the empty spool on the left side. You'll put in a new ribbon where the empty spool is, then thread it back to the other spool that holds the used ribbon.

Remove the old ribbon and throw it away. Make sure you save the two center hubs or spools (you'll need them later). You have now successfully gutted your cartridge.

Open the new cartridge and detach the ribbon from the other empty spool. Then place the new ribbon onto the left axle of the old cartridge.

Here is where the first problem may arise.

The center hole in the spool may be a different size than the axle in your old cartridge. In my case the hole was too large. Examine the old spool, which fits the axle (it consists of a black outer ring and an inner hub). The outer ring slides off, and the inner hub fits into the hole of the new spool.

The second time I tried this the old inner hub didn't fit. You have two alternatives; you can either wrap a piece of paper around the axle (make sure the spool turns freely) or just let it rattle.

When the ribbon is on the axle, make sure it is unrolling in the right direction. As the spool unwinds, it should turn clockwise. Rethread the ribbon through the rollers and the guide, then out the arm and into the other arm. Fit the ribbon between the two gears that are pressed together by a spring by depressing the gear with the spring to make a small gap between the gears. I found it easier to remove one of the gears completely, position the ribbon and then replace the gear.

All that remains is to attach the loose end of the ribbon to the old spool. Make sure the ribbon is not twisted. When the ribbon winds up, the spool turns clockwise. Use a small piece of tape to attach the ribbon to the left side of the spool, and make sure the ribbon is properly aligned. Now fit the top half of the cartridge back on, and press the sides together tightly. This is important at the ends of the two arms, for if they are not firmly together, the ribbon may slide between the seams, catch and snap. With the top of the cartridge back on, replace the rubber band on the knob and axle.

Pull the ribbon to see if it unrolls freely. If it doesn't, the top half of the cartridge may be pressing down on the spool. Take the table knife and slip it into the seam again to free the spool inside. Once the ribbon comes out with a gentle pull, you're ready to replace the cartridge on your printer.

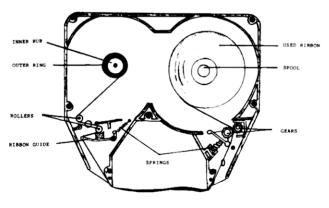


Figure 1

#### Here's an explanation of their functions.

### **NEWDOS80** Files

Randy M. Resnick 162 rue de la Convention 75015 Paris, France

Remember your innocent days when above all you preferred to read comic books? The styles varied drastically between Superman and Donald Duck, but all comics shared one convention. When the villain was foiled or Dewey slipped on a banana peel, they shook their fists and yelled \*#%&!#!!!

I suspect that when you got to the end of the NEWDOS80 manual and started looking at the documentation for the five

#### The Key Box

Basic Level II Model I 32K RAM One disk drive NEWDOS80 new file types, many of you shook your fists and uttered even more sophisticated oaths. Assuming that you have at least glanced over Appendix A in the manual or Section 8 on Disk Basic I/O enhancements, I propose to lead you to the light at the end of the tunnel.

It is not the fault of the authors of this fine operating system that standard ASCII just does not have enough unique characters for all of NEWDOS 80's functions.

In Basic Level II and up, the four characters %, !, # and \$ are variable type declarations. Most of you know and use the \$ suffix for a string variable as in A\$, C1\$ or P\$(1,4). Likewise, % designates an integer variable, ! means single precision, and # means double precision. You do not always see all these symbols in a program because they can also be defined at the beginning by a line like this:

10 DEFINT A-F:DEFSTR R-Z

You knew all that. So did I and so did Apparat. They had little choice, however, but to assign additional uses to these same characters. What do you make of this, for example:

70 GET 1,#,,(10)#,L%,R#;

Not only do these symbols have more than one meaning, but they can appear three times in one line and represent three different things.

When I first examined the examples in the book, I found them very confusing. With a bit of study and practice, however, the different meanings, in context, are as obvious as the difference between two, too and to in spoken conversation.

#### **GETting to the Point**

Some file types require that you use a declaration symbol for all variables, and in some you must indicate the exact length of a string. Unlike Basic, there is no default variable. (With added power comes added responsibility.)

In line 70 above L% and R# are simply the two variables, integer and double precision respectively, that the statement wants to GET.

What's between the GET 1 (1 is the buffer number, File Area Number in NEWDOS80 terms) and the variables? We'll get to

that in a moment. First, look at this elegant model:

10 OPEN "0", 1, "FILE", "FI" 20 PUT 1,,,A%; 30 CLOSE

The FI file type, threateningly referred to as "fixed-item, usersegmented," must be hard since it's the last thing in the book, right? Wrong! All five new file types require that you inform the system of the type you are using. So, lines 10-30 opened an FI file, wrote one integer value to it, and closed it. We could have written several values in a statement such as this one, and many thousands with the proper loop surrounding it. No fielding is involved. We wrote two bytes of data in LSB-MSB order (also known as internal format because this is how an integer is stored in memory) to the disk.

If A% equaled – 12345 and was written to disk using the PRINT#1 statement, it would use seven bytes of disk storage. The minimum number of bytes that a PRINT#1 statement will use for an integer variable is three: one for the sign, one per digit and a trailing blank. Yet, all integers in an FI file use two

bytes. It is easy to see that if you wrote 1000 integers to a regular sequential file, you could waste an average of two full tracks (4096 bytes) of disk space.

I rewrote a program that stored a 3 by 1024 element integer array to disk, changing the file type from PRINT#/INPUT# sequential to FI by modifying four statements. The original file this program created was 36 sectors long and the new one with the same data took 24 sectors. Most data values in the array were zero; all were limited to three digits. If the array were full of two to five-digit integers, the difference could be more than 300 percent-better than triple density!

Examining line 20 of my program gives us the syntax for the GET and PUT commands for NEWDOS80 files. After the GET command and its buffer number and comma are two more commas, the variable name and a semicolon. These last two items have a name: IGEL (Item Group Expression List). An IGEL is much easier to tame than a Field statement. It is simply a list of variables, each typedeclared, separated by commas and ending with a semicolon. An IGEL can also exist by itself in a line or several lines such as:

145 GOTO 155 150 A%, B%, G\$:' three integers 151 L\$(X,1), R#;:' string and numeric 155' program continues . . .

Your program must branch around the items in the IGEL. See the manual for more examples and how to use comments in the lines of an IGEL to enhance readability. If the IGEL has its own line number, it is called a free-standing IGEL. To use one in a program, the syntax is: 20 GET 1,,150. There is no ending semicolon, and only one comma is used after the comma that comes with GET 1. You will often use the same IGEL for GET and PUT statements in the same program. This version of line 20 would read the disk data of the file and assign it to the variables named in lines 150 and 151 above, assuming the data is written with exactly the same types of variables in the same order.

If you want to write a sequen-

tial file of the FI-type numbers only, and use it like the PRINT#/INPUT# type files, you have the tools to do so. Program Listing 1 is an example.

The first four lines fill the array with 1278 useless numbers between – 10000 and + 10000. I encourage you to substitute meaningful data for this section, such as the 426 highest scores in Chess Master Version 3.0, the dates they were achieved, and whether they increased in the last game.

The other odd-numbered lines are remarks. Using a free-standing IGEL, the program is easy to write and debug. Compared to a PRINT#/INPUT# type file program, it accomplishes the same task about 28 percent faster, and uses 1/3 the amount of disk space to store the same data.

To use strings in such a file you must state their lengths in the IGEL such as (23)A\$ or (5)Q\$(X,Y). This number creates a space in the file for the string. If the actual string is longer, it is truncated and, if shorter, the remainder of the space is filled with binary zeros (nulls).

You can randomly access these new file types as well! The MF and FF type files are similar to TRSDOS's random files, except that you decide the record length (1-4096) and you do not need Field or LSET and RSET statements. The system keeps track of record numbers for you. For other file types, you must know where the record you want is located in the file (called its RBA). Further, if you have already worked with random files. you will appreciate the fact that some NEWDOS80 file types can manipulate a part of a record without re-writing the whole record. This can be complex, and I would not try it on payroll files during working hours! Even so, if you work with long records, partial I/O can save access time, and in some cases can avoid the loss of important records.

#### **File Positioning**

If you dream in Assembly language, if you can multiply 16-bit hex numbers (signed or unsigned) in your head, or if you have read this far, you will have no trouble understanding file positioning.

100 OPEN "R",1,"FILE","FI"

Where are we? At the first byte in the file. If no other control information is specified for a GET or PUT statement executed just after an OPEN statement in modes I, O, R or D, NEW-DOS80 processes the data from the first byte of the file. If we asked for data after the EOF we would get an error and program execution would be broken, so the first necessity is a test for the end of the file. (Note: Program abort by error does not

close the file nor does it necessarily write any data. This is great for troubleshooting, but you should proceed with caution!)

NEWDOS80 has extended the LOC() statement to five separate functions. The LOC()\$ function, used with an FI file, returns a zero when it occurs before the EOF (end of file), and a minus one when it is positioned at or beyond the EOF. A test for EOF could be as simple as that of Program Listing 2.

Since LOC()\$ is always zero except at or beyond the EOF, line 120 will fall through the test until

- 3 DIMA%(2,425)
- 5 FOR X = 0 TO 425:FOR Y = 0 TO 2
- 7 A%(Y,X) = RND(20000) 10000:NEXT Y,X
- '---sequential output of array -
- 10 OPEN"0",1,"FILE","FI":GOTO 30: branch around IGEL
- 20 A%(0,X),A%(1,X),A%(2,X);:'--- IGEL ---
- 30 FOR X = 0 TO 425:PUT1,,20:NEXT:CLOSE
- 41 'program continues . . . .
- 49 ' -- sequential input to array --
- 50 OPEN"I",1,"FILE","FI"
- 60 FOR X = 0 TO 425:GET1,,20:NEXT:CLOSE
- 61' No need to test for EOF.
- 63' we know the file has 426 rec's

Program Listing 1. Storing integers in an FI file



100 OPEN"I",1,"FILE","FI",C = 1

110 GET 1...Z%;

120 IF LOC(1)\$ THEN 140

130 C=C+1:GOTO 110

140 CLOSE

150 PRINT"Last Item Processed, Rec ";C

Program Listing 2. EOF test in FI file

1180 OPEN"R",1,"FILE","FF",12

1190 A\$ = "hello test": B% = 100

1200 PUT 1,,,(10)A\$,B%;

1210 GET 1,#,,(5)D\$;

1220 GET 1, • , ,(5)L\$;

1230 GET 1,+,,U%;

1240 CLOSE

Program Listing 3. File positioning within a record

it becomes true. The exact point where LOC()\$ becomes true depends on the file type and several other functions, including:

LOC()!—This returns the Relative Byte Address (RBA) of the next item (the one about to be processed) in the file. This item is the next record in record segmented files or the next byte in non-segmented files. The data at this location will be processed by the next access. This value is zero before the first access.

LOC()#—This is the start of the last record processed. It is called the REMRA (REMembered Record Address). If LOC()! is zero there is nothing to remember, so this value is marked invalid by the system and asking for LOC()# will

create an error.

LOC()%—This is the current EOF address of the file. When extending files in the R or E modes, this value and the data added to the file may not be written to the disk yet, so in the case of a crash, it is possible to lose all new data. Close updates the EOF on the disk. To force this update without a Close, the statement PUT 1,&,,; ensures sensitive data is written before further processing. It has no effect on file positioning. The form PUT 1,1%,,; positions a pointer to the current EOF from anywhere in the open file.

These last three functions of LOC() return byte addresses relative to the first byte of the open file; there are some differences in their functions as well as that of LOC()\$ among the five file types. These differences relate to whether the file is segmented into records. If it is segmented, these RBA and REMBA values indicate the beginning of a record; in unsegmented files, they indicate the next byte in the file. This is the trickiest part of playing with these LOC functions, and requires experimentation. Keep in mind that you will see a lot of error messages. The manual is very explicit about the LOC functions, so take another look at it if you have problems.

#### The Easy Way

If you open an MF or FF file in any of the random modes, you must state the record length in the Open statement. These two file types can be accessed randomly by record number (as in GET 1,45,50 or PUT 1,45,,A%; where you will be moving data at record number 45, either into the IGEL with the line number of 50 or from the IGEL within the same line as in the PUT). The system does not know the record numbers in the other three file types, but you do.

If your data is segmented so all records in the file have the same length, you can easily compute the position of a record just like the system does. Other than making your listings more complicated, there is little reason to do this, since you can let the system handle it, by using MF or FF files. It is good to know

the formula to better understand the process and for debugging purposes. Multiplying the number of bytes in the record by the number minus one of the record you wish to obtain gives the relative byte address (RBA) of that record. You subtract one because the first record number is one, but the lowest byte address is zero. That is, in a file of 10-byte records, Record 1 is at (1-1)+10 or zero, Record 2 starts at (2-1) \* 10 or 10, Record 234 starts at 2330 and so on. This Relative Byte Address (RBA) is designated by the symbol! Instead of asking NEWDOS80 for LOC(1)! for example, you tell it:

#### 230 GET 1,!2330..;

If you asked for LOC(1)!, NEW-DOS80 would answer 2330 for an unsegmented file, and in the FF file discussed above (which has a stated record length of 10) would answer 2340, the next record's RBA. Note that this GET did not GET anything. It only positioned the file, because it has a null IGEL in it. The same line with a non-null IGEL or IGELSN (that is IGEL plus SN for Statement Number) would perform a normal GET function. PUT 1,!2330.,A%; would indeed write the two byte form of the value of A% starting at the relative byte 2330.

If your data structure is not this simple, you can build an index file while you are writing the data. The first item written will always be at !0, the first byte in the file. After the first PUT, you could ask for the value of LOC(1)! and store it in an array. When the entire file is written, your array contains the RBA or Relative Byte Address for each record, regardless of the varying lengths of these records. You can then store this array to disk as an index file which you can use later for sequential or random access or sorting purposes. Picture the efficiency of loading an array with the record positions from an index file, accessing a single value in a very long record, sorting the values, rearranging the index numbers in this new sorted order and writing them to a new index file. The speed and space gained will amaze you! (See the partial



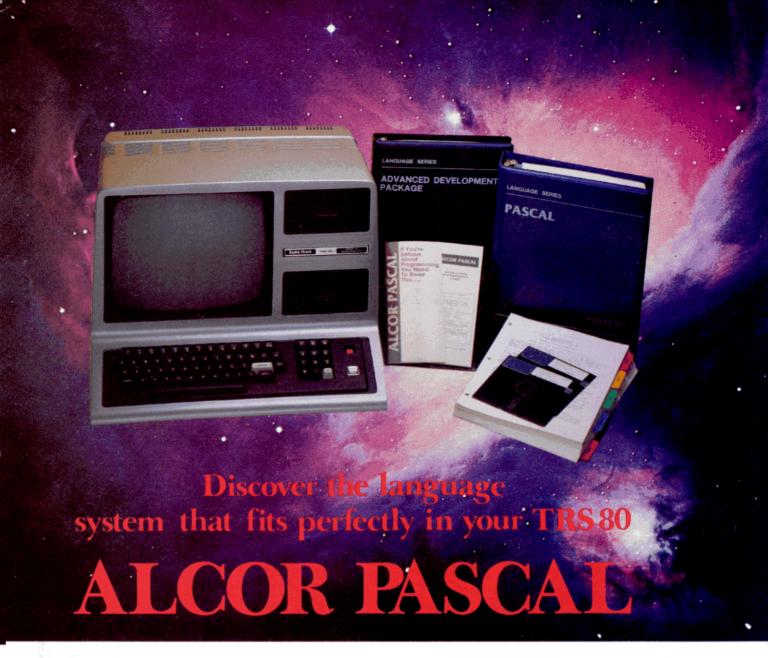


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record I/O in the manual.)

Regardless of where you are in a file, GET or PUT without explicit positioning will process the next record (if the system knows the record length or the file is marked) or the next item if the file is unmarked. We'll get to marked items in a moment, but first there are a few other symbols to clear up. Refer to Program Listing 3.

Here, the file opened is an FF type file and the stated record length is 12. Do you care to guess the values of D\$. L\$ and U%? In the first record we wrote a 10-letter string and an integer value. The # in line 1210 sent Basic back to the REMRA or last record processed instead of advancing to the next one, and read the five characters Hello into D\$. The \* in line 1220 forced the action to remain in the same record and to start at the next byte to read the "test" part of the string. The same command in line 1230 read 100 into U%. If the system is not told the record length the \* symbol does not accomplish anything. To read or modify a single item in a record. or to change the structure of the record requires that you know exactly how data is organized. Other partial record techniques include:

● GET 1,,,A%,,C%; The extra comma between variables skips

the variable between A and C in marked-item files.

- GET 1,,,(7)\$,A%; In fixeditem files, the number of bytes in parentheses is skipped from the current position and A% is read.
- PUT 1,,,(10)#,A%; In fixeditem files, the number of bytes in parentheses is nulled and A% is written. Handle this with care!

#### Marked-Item Files

After all this work, let's let the system handle things for a change. Of course, the system is paid in bytes and marked-items make it work overtime. Another general point: In marked-item files, the PUT statement IGEL can use expressions, like 3\*A!/234.3-20 and MID\$(D\$,2,X+5), or literals and constants as in PUT 1,,,"abc",12.3;.

The code in Program Listing 4 will create an MU file of five records, each consisting of a string entered from the keyboard followed by a numeric expression related to the string length. The computer prints the record number and waits for you to enter some data. As soon as you hit enter the fifth time, it places this important data on the disk.

After creating the file, examine it with Superzap. The marking bytes within the file are well defined in the manual. In the MU type file, each record

1001 CLS:FOR X = 1 TO 5
1002 PRINTTAB(25)"REC";X;:PRINT:LINEINPUTA\$(X)
1003 NEXT
1004 OPEN"O",1,"TEST/MU","MU"
1005 FOR X = 1 TO 5:------ WRITE FIVE RECS TO FILE

1006 PUT1...A\$(X),5+LEN(A\$(X)) + 2;

1007 NEXT

1000 CLEAR 1000

1008 CLOSE

Program Listing 4. Create and write MU file of strings and integers

2000 DIM I(100): dimension array to max. possible records.

2002 CLS:L = 1:OPEN"I",1,"TEST/MU","MU"

2004 GET1,,,;:I(L) = LOC(1)!:' no data transfer

2006 IFLOC(1)\$THEN2010

2008 L=L+1:GOTO2004

2010 CLOSE:PRINTL;" RECORDS IN FILE"

2012 PRINT:PRINT"REC RBA":PRINT

2014 FOR X = 0 to L - 1:PRINT X + 1;" ";1(X):NEXT

2016 PRINT" = = = EOF = = = = >";I(L)

Program Listing 5. Create index array I() with RBA for each record

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Each program, designed for the Model II or 16, will work with one or more floppy or hard disks. With each program, I'll include a 200 page manual written with the first time user in mind, and a set of sample data files so you can start using the program right away.

But I won't stop there. If you have a question, or a problem, call me. You won't get an operator, or order taker. You'il get me. And if I can't talk to you on the spot, I'll call you back. And I'll fix your problem. FAST.

Now I could say a lot more about these programs, but you really won't know how good they are until you try them. So, order the programs you need, and try them for 14 days. If you're not convinced that these are the programs for you, send them back, and I'll refund your morey.

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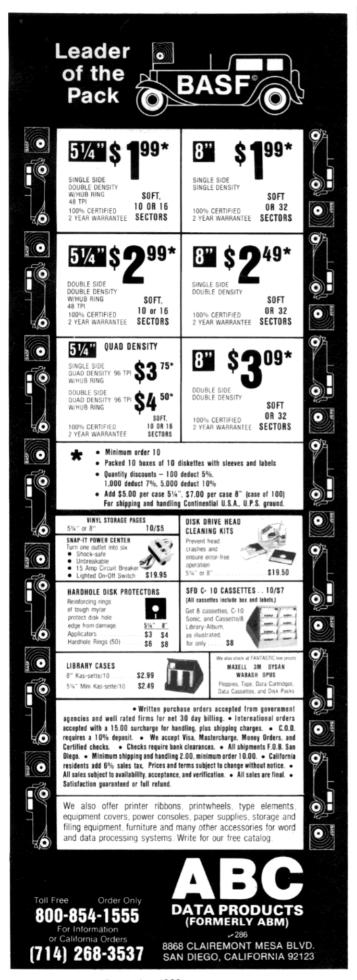
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begins with a start-of-record mark (SOR). This adds one byte of overhead for each record, but in working with variable length strings, the strings can be read in order, because the system knows where each one starts. A marking byte is also added to each numerical item in the file to tell the system whether it is integer, single or double precision, and to each string to tell the system its length. Strings exceeding 127 bytes use two marking bytes.

MU type files are easy to work with and flexible but use extra disk space and can be slow. Random processing is possible using the RBA file positioning techniques discussed earlier. The MU file, as the manual states, was intended to replace PRINT#/INPUT# file types and is excellent for data that is widely varying in nature, such as strings 0 to 255 characters long mixed with numbers of varying precision.

Program Listing 5 is a quick demonstration of how to build an index array from the MU file. You could save the index as another file, or use it for processing during program execution. Try it on the five-record MU test file, with the array I() containing the RBA values. GET 1.!I(0),.A\$.B; obtains the first record, and record N would be accessed using GET 1,!I(N - 1),... This allows true random access to a file containing records of varying lengths. The extra marking bytes eliminate the space wasted in field item files. The MU file can be updated as well, but the new record must fit into the same space as the one it replaced.

If you can use strings that are of consistent length (e.g. phone numbers), there are more appropriate file types. For example, if a file contained only strings of seven characters mixed with integers, you might use an MF file setting the record length at eight for the string plus three bytes for each integer, five for single precision, and nine for double precision numbers. You can process this type of file by record number. Again, the more you think out your data format, the easier it will be to choose the right file type for fast access and disk space economy.

If the data is mixed but in an iron-clad format, you can use the MI type file. This file type can not be updated randomly, but it can be read using the intra-record techniques described earlier.

#### The Structure of File Types

Here is the order of how much work the system does, from almost none of it to nearly all the housekeeping:

FI: This file is a continuous stream of data bytes. All control is in the programmer's hands. If you ask for a number and are positioned at a string, the system will calmly return a completely meaningless value. The system can not help you recover. It has no way to detect such an error, unless you try to input past the EOF. These files are very compact but require that you be aware of every facet of the data structure.

FF: All records have the same length, which you must state in the open statement. Expressions are not allowed in the IGELs. The system will handle I/O by record number. Again, the files are very compact, and other than the record length, the system is ignorant of the data structure. An important attribute of this file type is its ability to process a single item in a record without reading or writing the whole record.

MI: The system adds bytes to the data in the file to mark their types. The file can only be written sequentially (or extended), but can be read randomly by file positioning.

MF: This file is like MI but you can update it randomly and access it by record number or file positioning. Expressions are allowed in IGELs. You specify record length in the Open statement.

MU: The system marks all items and the start of each record. This type adds the most extra bytes, but is very flexible with records and strings of varying lengths. Used with an index file containing the RBA of each file SOR, strings of up to 255 bytes can be rapidly accessed randomly and sorted or manipu-

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These new features, added to the existing capabilities of NEWDOS/80, makes it one of the most powerful additions you can make to your system. And Apparat's commitment to support assures that you've purchased a superior product, both today and tomorrow. At just \$149.00 it could be the best investment you will make for your TRS-80.

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lated using this index file. The MU system is very easy to use and understand.

#### **Final Thoughts**

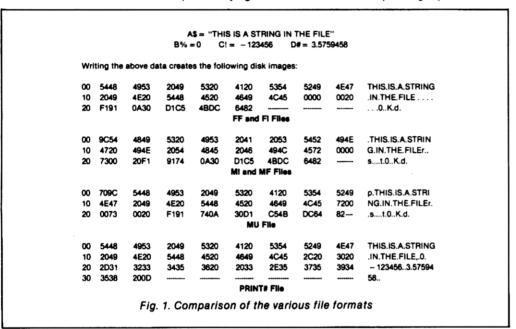
Hundreds of other details, tricks and tidbits can be learned by experimentation or gleaned from the NEWDOS80 documentation. The program modules included here could be compressed considerably, and there is a lot of room for sophisticated programming techniques once you have mastered these fundamental concepts. I have found them to be well worth the time spent studying them.

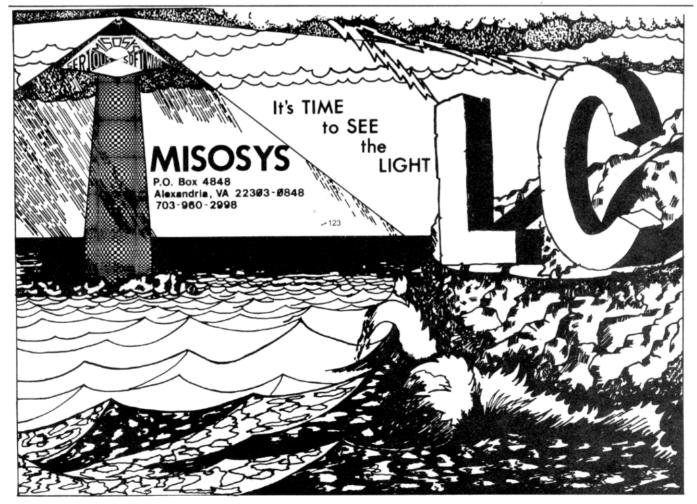
One way to picture the entire file situation in NEWDOS80 is as an analogy to computer languages. In Basic and other highlevel languages, you enter words and numbers and manipulate them, without knowing how or where they are stored. The operating system makes

the rules, and sometimes uses time analyzing data and worrying about where to put it in memory. Some of us rebel in the face of such a dictatorship. The need to be independent of the operating system's tyranny gives us the desire to direct the computer and run things our own way. To do this we learn to use Assembly or machine language. My first Assembly language program stored and analyzed one string. I had to write the program this way, since that string happened to be 43,548 characters

NEWDOS80's new file types give you the power to create your own data structures and use your imagination more freely than do the older (still fully supported) file types. At the very least, you can save disk space and time. The rules are still in the hands of the operating system, but the choice is so varied you hardly notice!

Randy Resnick is a musician living in Paris. He is currently working on laser-graphic systems





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## Color Diskdump

#### by Ken Knecht

Thave written a Basic program for the TRS-80 Color Computer that lets you see what is stored in a disk file. The program also reads any area of memory.

Since the Color Computer displays 32 characters on each line, many lines are needed to display a single disk sector of 256 bytes. This program displays the decimal codes of each character in the file with their ASCII equivalent above them—if it is a printable ASCII character. If the ASCII character is a space then no character is shown. If the character is not printable then a period is displayed. You can choose to print the program's output on your printer if you have one.

When you start the program, you are asked for the name of the file. You can also select a display of memory. The file can be any type: direct, sequential, data, Basic program, machine language and so on. Next, you are asked which sector you wish to begin with. The program tells you if this sector is beyond the length of the file. If the sector is valid, as the program continues you have frequent opportunities (every 32 bytes) to restart the program and look at another file or another sector of the same file. When each sector has been displayed, you can restart the program, go to the next sector, or display any sector.

The location of the bytes displayed within the sector is displayed above every eight-byte line together with the

The Key Box
Color Computer
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One Disk Drive

Model I users had it; now Color Computer owners can have it, too. So examine those files.

sector number. You are always aware of where you are in a file. The sector count begins with one, and the byte count within the sector with zero.

If you choose to read memory, the display is the same, except you see the contents of memory. You are asked for the starting memory address. After each four lines you can continue incrementing memory addresses, start at a new address, or end the program.

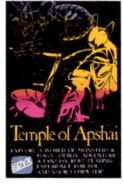
Ken Knecht can be reached at 1340 W. 3rd St. #130, Yuma, AZ 85364.

```
10 CLEAR1000:P=0:CLS
20 INPUT"OUTPUT TO PRINTER (Y/N)"; Z$:IF Z$="Y" THEN P=-2
25 INPUT"READ FROM DISK OR MEMORY (M/D)"; Z$:IF Z$="M" THEN 230 30 F$="":PRINT"FILE NAME (PRESS ENTER TO":INPUT"END PROGRAM)"; F$:IF F$="" THEN END
40 INPUT"STARTING SECTOR";S
50 OPEN"D",1,F$:IF S>LOF(1) THEN 210
60 FIELD#1,128 AS A$,128 AS B$:GET #1,S:V=0:SK=0
70 FOR X=0 TO 96 STEP 32:FOR Y=0 TO 31 STEP 8:PRINT *P, "SECTOR"; S
 "BYTES"; V; "TO"; V+7
80 FOR Z=1 TO 8
90 L$=MID$(A$,X+Y+Z,1):L=ASC(L$):IF L<32 OR L>122 THEN PRINT*P,"
. ";ELSE PRINT*P," "+L$+" ";
100 NEXT Z:IF P=-2 THEN PRINT*P," "
110 FOR Z=1 TO 8
120 L=ASC(MID$(A$,X+Y+Z,1)):IF L<10 THEN PRINT*P," "+STR$(L)+" "
;ELSE IF L<100 THEN PRINT*P,STR$(L)+" ";ELSE PRINT*P,STR$(L);
130 NEXT Z:IF P=-2 THEN PRINT*P," "
135 V=V+8:NEXT Y
140 INPUT"CONTINUE (Y/N)"; Z$:IF Z$="Y" THEN 150 ELSE 220
150 NEXT X:IF SK=0 THEN SK=1:A$=B$:GOTO 70
160 PRINT"INPUT -1 TO END, 0 FOR NEXT":PRINT"SECTOR, OR THE SECT
OR NUMBER": INPUT"FOR A SPECIFIC SECTOR"; N
170 IF N=-1 THEN 220
180 IF N=0 THEN S=S+1:IF S>LOF(1) THEN 210 ELSE 60
190 S=N
200 IF S<=LOF(1) THEN 60
210 PRINT"NO MORE DATA IN FILE"
220 CLOSE:GOTO 30
230 B$="":PRINT"START AT WHAT MEMORY ADDRESS":PRINT"(PRESS ENTER
 TO QUIT, A":PRINT"A POSITIVE NUMBER FOR ADDRESS":INPUT B$:IF B$
     THEN END ELSE B=VAL(B$)
240 FOR Y=1 TO 4:PRINT*P, "BYTES"; B; "TO"; B+7:FOR Z=B TOB+7:L=PEEK
250 IF L<32 OR L>122 THEN PRINT*P, " . "; ELSE PRINT*P, " "+CHR$(
260 NEXT Z:IF P=-2 THEN PRINT#P," "
265 FOR Z=B TO B+7:L=PEEK(Z)
270 IF L<10 THEN PRINT#P," "+STR$(L)+" ";ELSE IF L<100 THEN PRINT#P,STR$(L)+" ";ELSE PRINT#P,STR$(L);
280 NEXT Z:IF P=-2 THEN PRINT#P," "
285 B=B+8:NEXT Y
290 INPUT"CONTINUE (Y/N)"; Z$: IF Z$="Y" THEN 240 ELSE 230
```

Program Listing

## Slaying Monsters Should Be Mostly Fun and Games

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### Forms Maker

#### by Charles Perelman

Here's an easy-to-use utility that creates forms, such as invoices, on the Model II screen. With the arrow, tab, and repeat keys you can move rapidly around the screen placing keyboard characters where you want them. You can erase or type over any entry, copy the form directly to the printer, or save to disk for future use.

Although written in Basic, the program takes advantage of the Model II supervisor calls with machine-language USR routines. The program was written with TRSDOS 2.0. Twenty-two lines are available for your forms. Instructions appear at the bottom of the

# With USR routines and this Basic utility, you can create business forms on your Model II.

screen. Use valid TRSDOS file names when saving forms to disk.

#### **Program Overview**

The program is modular and self-documenting. USR routines are identified with U variables. Lines 220 and 230 load a Basic patch to implement PEEK

for reading the screen. Additional machine language is read in lines 240–320 for the screen-to-printer routine and to prepare registers for the screen-to-RAM and screen-to-disk routines. Data line 12020 contains the PEEK instructions, and line 12030 contains the screen-print routine.

Movement of the cursor with the arrow keys is nondestructive. From the top line, the up arrow moves the cursor to the bottom of the screen in the same column and vice versa with the down arrow from the bottom line. From the right margin, the cursor moves down to the beginning of the next line. Moving backwards, it goes up to the end of the previous line. From the right edge on the bottom line, the cursor moves to the beginning of the same line. Tab erases any characters it passes over.

The error traps go to error-handling routines beginning at 10270. When working with a form, after pressing <CTR L> <P> for printout you must turn on the printer to continue with the program.

Forms Maker lets you make master forms as needed for reproduction on a copier or with a stencil. Revisions are simple and efficient with the masters on disk.

Charles R. Perelman (9777 Wilshire Blvd., Beverly Hills, CA 90212) is an attorney, a CPA, and a certified tax specialist.

The Key Box

Model II TRSDOS 2.0 Model II Basic

```
Program Listing
10 '*************
20 FORMS MAKER
30 'BY CHARLES R. PERELMAN, A PROFESSIONAL CORPORATION 40 '9777 WILSHIRE, BEVERLY HILLS, CA. 90212, 1982
110 'INITIAL SETUP
120 CLEAR 2000
130 DEFINT L,M,S,U-Y
140 DIM U1(23), U3(12), S(959)
200 *******
210 'IMPLEMENT PEEK AND SCREEN PRINTER
220 FOR X=0 TO 23:READ U1(X):NEXT
     V = 0: DEFUSR = VARPTR (U1(0)): V = USR (0)
2 3 0
240 FOR X=0 TO 12:READ U3(X):NEXT
300
310 'SET UP REGISTERS FOR USR CALLS
320 U2(0)=15872:U2(2)=8448:U2(4)=4352:U2(6)=256:U2(8)=-13873
510 'INSTRUCTIONS
520 CLS:PRINT"MODEL II REQUIRES FILES TO BE OPENED WHEN ENTERING
 BASIC. IF YOU": PRINT"NEGLECTED TO DO THIS, PRESS <BREAK>, TYPE 'SYSTEM', PRESS <ENTER>.": PRINT"THEN TYPE 'BASIC FORMSMKR -F:1'
 AND PRESS <ENTER > TO RESTART."
530 PRINT: PRINT"
                     IF YOU HAVE OPENED A FILE, PRESS <ENTER > TO C
ONTINUE."
540 Z$=INKEY$: IF Z$="" THEN 540 ELSE IF ASC(Z$) <> 13 THEN 540
550 CLS: PRINT@25, "FORMS MAKER": PRINT: PRINT"
                                                    AFTER MAKING CHOIC
E FROM MENU, USE ARROW KEYS AND TAB TO POSITION.": PRINT"CURSOR O
N SCREEN.
            TYPE IN ANY KEYBOARD CHARACTER ON TOP 22 LINES."
560 PRINT"CHANGE BY OVERTYPING OR ERASE WITH BACKSPACE OR SPACE
BAR .": PRINT"
                PRESSING THE <CRTL> KEY AND <X> WILL RETURN YOU T
  THE MENU.": PRINT" < CRTL > < CD > SAVES THE SCREEN TO DISK, AND < CRTL
                                                              Listing continues
```

## THE COLORQUEST EXPERIENCE For the TRS-80C and the TDP System 100 Color Computers





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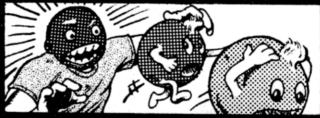






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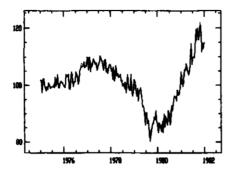
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Listing continued

><P> PRINTS HARD COPY.": PRINT: PRINT"PRESS ENTER TO CONTINUE."; 570 Z\$=INKEY\$: IF Z\$="" THEN 570 ELSE IF ASC(Z\$)<>13 THEN 570 610 'MAIN MENU 620 CLS:PRINT@340,"MAIN MENU":PRINT:PRINT"1. CREATE NEW FORM":P EDIT OLD FORM.": PRINT"3. RECALL CURRENT FORM FOR EDIT. RINT"2. ": PRINT"4 . END PROGRAM.": PRINT: PRINT"PLEASE PRESS NUMBER FOR CH OICE.": 630 Z\$=INKEY\$: IF Z\$="" THEN 630 640 IF INSTR ("1234",Z\$)=0 THEN L=911:M=1:GOSUB 10120:GOTO 630 650 CLS:ON VAL(2\$)GOTO 1020,2020,3020,4020 1000 \*\*\*\*\*\*\*\*\*\*\*\*\*\* 1010 'CURSOR MOVEMENT 1020 PRINT@1840, "PRESS < CRIL> AND: <X> FOR MENU, <D> TO SAVE TO DISK, <P> TO PRINT"; :PRINT@0,""; 1030 B\$=INKEY\$:IF B\$="" THEN 1030 1040 IF ASC(B\$)=28 OR ASC(B\$)=8 OR ASC(B\$)=9 THEN PRINT B\$; 1050 IF ASC(B\$)=31 AND ROW(Z)=21 THEN L=POS(Z):PRINT@L,"";ELSE I F ASC(B\$)=31 THEN PRINT CHR\$(255): 1060 IF ASC(B\$)=30 AND ROW(Z)=0 THEN L=1680+POS(Z):PRINT@L,"";EL SE IF ASC(B\$)=30 THEN PRINT CHR\$(254); 1070 IF ASC(B\$)=29 OR ASC(B\$)>31 AND ASC(B\$)<128 THEN PRINT B\$; 1080 IF ROW(Z)>21 THEN PRINT@1680,"";:GOTO 1030 1090 IF ASC(B\$)=4 THEN GOSUB 10220:GOTO 1020 1100 IF ASC(B\$)=24 THEN W=1:GOSUB 10320:GOTO 1110 IF ASC(BS)=16 THEN GOSUB 10420:GOTO 1020 1120 GOTO 1030 2000 \*\*\*\*\*\*\*\*\*\*\*\*\* 2010 'LOAD FORM FROM DISK 2020 PRINT@320, "ENTER NAME OF FILE TO RECALL: ";:LINEINPUT F\$ 2030 ON ERROR GOTO 10270 2040 CLS:PRINT CHR\$(02):OPEN"I",1,F\$:PRINT@1840,"FILE NAME IS: " 2050 FOR L=0 TO 1680 STEP 80:GOSUB 10520:LINE INPUT#1.AS:PRINT A S:: NEXT 2060 CLOSE: PRINT CHR\$(01):GOTO 1020 3010 'RECALL FROM RAM 3020 W=2:GOSUB 10320:GOTO 1020 4000 \*\*\*\*\*\*\* 4010 'END PROGRAM 4020 PRINT CHR\$(31)+CHR\$(26):M=3:GOSUB 10120:PRINT CHR\$(30):END 10000 \*\*\*\*\*\*\*\*\*\*\*\*\* 10100 'SUBROUTINES 10110 'FLASHING MESSAGES 10120 E\$(1)="ONLY 1 TO 4 PLEASE": E\$(2)="FILE NOT FOUND": E\$(3)="B YE FOR NOW": E\$(4)="TURN PRINTER ON": E\$(5)="IMPROPER FILE NAME."

10130 PRINT CHR\$(02):FOR X=1 TO 2:PRINT@1760,"\*\*\* "+E\$(M)+" \*\*\*" ;: FOR Y=1 TO 800: NEXT 10140 PRINT CHR\$(25):PRINT@1760,SPACE\$(80);:FOR Y=1 TO 500:NEXT: NEXT X:PRINT CHR\$(01);:PRINT@L,"";:RETURN 10200 \*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 10210 'SAVE TO DISK 10220 ON ERROR GOTO 10270 10230 PRINT@ 1760, "ENTER FILE NAME: ";:LINEINPUT F\$:PRINT@1760, "SAVING FILE 10240 OPEN "O",1,F\$ 10250 FOR L=0 TO 1680 STEP 80:GOSUB 10520:PRINT#1.AS:NEXT 10260 CLOSE: PRINT@1760, SPACE\$ (80); : RETURN 10270 IF ERR = 53 THEN M=2:GOSUB 10120:RESUME 620 10280 IF ERR = 52 THEN PRINT: PRINT: PRINT"FILES NOT OPENED WHEN BAS 10310 'SCREEN TO RAM 10320 V1=0:U2(1)=94:U2(3)=VARPTR(S(0)):IF W=1 THEN U2(7)=-1 ELSE U2(7)=0 10410 'EXECUTE SCREEN PRINT 10420 M=4:GOSUB 10120 10430 V3=0: DEFUSR 3=VAR PTR (U3(0)): V3=USR 3(0): C\$=INKEY \$: RETURN 10500 \*\*\*\*\*\*\*\*\*\*\* 10510 'READ SCREEN TO A\$ TO SAVE OR LOAD 10520 V1=0:U2(1)=11:U2(7)=CVI(CHR\$(L-INT(L/80)\*80)+CHR\$(INT(L/80 ))): U2(5)=20480: A\$=SPACE\$(80): U2(3)=CVI(CHR\$(PEEK(VAR PTR (A\$)+1)) +CHR \$ (PEEK (VAR PTR (A\$)+2))): DEFUSR 2 = VAR PTR (U2(0)): V1=USR 2(0): RETU 12000 \*\*\*\*\*\*\*\*\*\*\*\*\* 12010 'MACHINE LANGUAGE USR ROUTINES 12020 DATA -13023,8797,26623,17441,8830,26625,-15583,8955,26627, 14910,1330,104,-12255,8773,10757,17697,8779,10759,-15583,8959,23 259,26430,-8910,-13990 12030 DATA 33,1784,-15082,-32450,-45,20486,3342,4296,4559,80,-16



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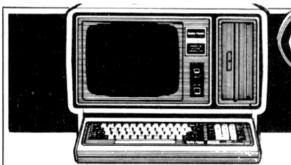
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## Screen Strings

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String variables play an important role in almost every program. Learn how your micro handles the strings and you can make your routines more efficient.

#### String Variables

When a string variable is put into a Basic program, the computer's type, name, length and address are stored in memory in the variable list table just above the program. Each string record occupies six bytes in the table (Fig. 1). The decimal values in the figure are for A\$, five bytes long, at decimal memory address 17143 (247 + 256\*66). The values for any variable can be found using the VARPTR command.

Enter the short demonstration in Program Listing 1. Line 30

finds the location of the record for A\$ in the variable list table. Line 40 gets the length of the string, 50 obtains the address of the string and 70 converts this address to a decimal number.

Run the program. Note the addresses of the string and its variable pointer. The string is located about fourteen bytes above the beginning of the program. The pointer is about 250 bytes above that, depending on your spacing.

Edit line 10 to read: 10 A\$ = "ABCDE" and run it again. The string length changes to five, as you might expect. The string address stays the same, while the pointer address increases by two (we used two more bytes in the program).

Enter as a direct statement (no line number): POKE VP,3: PRINT A\$.

The result is ABC. We changed the length of the string by changing the number stored in the address found by VARPTR. Next, if the LSB (least significant byte) of the string address is less than 254, try another direct statement: POKE VP + 1, LSB + 2: PRINT A\$.

This adds two to the address in the table telling where the string is stored. The result should be CDE. So, the computer can be told the length and address of any string by POKEing the values into the variable list table.

One more point. Change line 10 again: 10 A\$ = CHR\$(65).

This time A\$ = A, but its address is the last byte in your computer's memory. Any time a CHR\$ or STRING\$ is used in a string, or when two or more items are combined with a + to form a string, the computer assembles it in reserved string space in high memory.

Try: 10 FOR I = 65 TO 69: A\$ = A\$ + CHR\$(I): NEXT.

The location of A\$ will be 20 bytes below the end of computer memory. What is in those last twenty bytes besides our 5-byte string? We can PEEK them

to find out. But wait a minute! A\$ already points to the beginning of the 20 bytes. It is simpler to use a direct statement again: POKE VP.20:PRINT A\$.

The result is ABCDEEABCD DABCCABBAA.

Reading from right to left, the computer interpreted CHR\$(I), put it in memory, then added it to the existing A\$, which it also put in memory. It repeated this for five loops, each time using the next lower space in the reserved string area specified by the CLEAR nnn statement. In this instance, we did not reserve any, so the computer set aside 50 bytes for us.

#### **Defining a Screen String**

The video screen is memory mapped in addresses 15360–16383: a string can be created in screen memory. Make the following changes in the program and run it.

10 A\$ = ""
35 POKE VP,64: POKE VP + 1,0: POKE VP + 2,60
80 PRINT A\$

Line 10 creates A\$ in the variable list table. Line 35 makes it 64 bytes long, beginning at the screen's upper left (0 + 256 \* 60 = 15360 decimal). Now anything on the first line of the video screen is A\$ and is printed. To show this more vividly enter: FOR I = 1 TO 15:PRINT A\$;:FOR

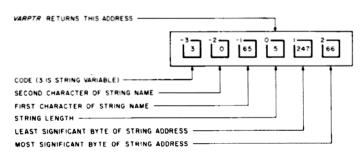


Figure 1

J = 1 TO 200:NEXT:NEXT

As the screen scrolls, whatever moves up to the first line becomes A\$.

Such a string can be made up to 255 bytes. It can be put anywhere on the screen as long as the whole string is within the limits of video memory.

#### Screen Strings for a Text Editor

To show the method's potential, consider a Basic text editor.

Text editors or word processing programs, handy for written communication, are very expensive. The basis of their operation is represented in this very simplified routine:

- 10 REM
- 20 I\$ = INKEY\$: IF I\$ = "" THEN 20
- 30 REM \* TESTS FOR CONTROL CHARACTERS HERE
- 40 TEXT\$ = TEXT\$ + I\$
- 50 PRINT IS:: GOTO 10

The program works well until it unexpectedly stops. If you were not watching the screen when it happens, you may lose a few words.

Why? Line 40 works like the loop in the demonstration program using 20 bytes of memory to create a 5 byte string. A 60-character line uses 1890

bytes ( $n^2/2 + 1.5 \times n$ ), leaving more than 1800 garbage bytes. When the reserved string space is full, the computer has to stop, sort out extra debris and rearrange current strings to make room for more before resuming its task.

By establishing a screen string for the video line where the input will be, we can delete line 40 and get TEXT\$ when the line is finished. With this method we create only 60 extra bytes for a 60 character line-one for I\$ each time a character is entered. You may wonder about all the times the program loops through line 20 when there is no input. The interpreter reestablishes the address of I\$ each time, even though it does not change. Since its length is zero, no string storage is used.

The reduction from 1800 to 60 bytes is a big improvement, but we can go further. A character picked up by INKEY\$ becomes I\$ and is stored in the next free space of the string storage area. The computer keeps track of the next byte in addresses 16598 and 16599. With our routine, each time another character is entered the address stored in 16598 is decremented by one.

DEMONSTRATION PROGRAM

5 CLS
16 AS="ABC"
20 T=24: PRINT "AS= " AS;
38 VP= VARTR(AS): PRINT TAB(T)"ADDR. OF VAR. PTR. =" VP
46 PRINT "LENCTH OF AS=IS" PEEK(VP);
56 LSB=PEER(VP+1): MSB=PEER(VP+2)
66 PRINT TAB(T)"ADDR. OF STRING: LSB=" LSB ", MSB=" MSB
76 DEC= LSB + 256\*MSB:PRINT TAB(T)"DECIMAL ADDR.OF STRING =" DEC
98 LIST 16-78

Program Listing 1

SAVE & RESTORE THE CONTENTS OF A SCREEN

Save The Screen

97 'S = MOST SIGNIFICANT BYTE OF SCREEN ADDR.

AS = SCREEN STRING INCLUDES 3 SCREEN LINES + 63 BYTES OF 4TH LINE

BS(8-3) = SAVES ALL BUT LAST BYTE OF EACH QUARTER OF THE SCREEN

P(8-3) = LAST BYTE OF EACH QUARTER OF THE SCREEN

108 S=60: AS="": VP=VARPTR(A\$): POKE VP,255: POKE VP+1,8: FOR I=8

TO 3:

POKE VP+2,S: B\$(I)=A\$: S=S+1: P(I)=PEEK(S\*256-1): NEXT: RETURN

Restore The Screen

107 'S = LAST BYTE OF EACH QUARTER OF THE SCREEN

118 CLS: S=15359: FOR I=0 TO 3: PRINT B\$(I);: S=S+256: POKE S,P(I):

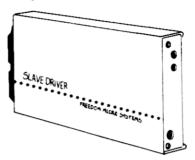
IF I<3 PRINT: NEXT ELSE NEXT: RETURN

195 '

Program Listing 2

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I\$ is used to compare to control codes and take proper action, or to print it on the screen. The current I\$ then becomes garbage. If only we could use the same location to store I\$ for the whole line

After the string location is established and the program is ready for a line of input, get the contents of the least significant byte of the string storage address with M = PEEK(16598). Then change line 10 in our simplified routine to 10 POKE 16598.M.

This will cause the same address to be used each time. Except for the rare instance where the first letter of a line is the last available byte of string storage, there is no pause during entry as there is no change in total string storage until the line is finished. This routine is also faster than the original, since no string concatenation takes place during input.

Another problem with Basic word processors crops up when they reach their specified line length in the middle of a word. The slight delay while shifting a word to the next line sometimes causes the loss of one or two letters. This is resolved by writing a short machine-language subroutine into the input routine so characters typed beyond the line length get a short beep from the amplifier. Input continues uninterrupted until a space is typed. The last word is shifted to the next line.

To make or revise your own word processor, use these hints on screen strings.

First, establish the screen string. POKE the desired line length plus twenty into the VARPTR to allow for overrun at the end of the line. Print the line number if desired. Then PEEK locations 16416 and 16417 for the current cursor location. Transfer these to the address of the screen string in the variable list table (in VARPTR+1 and VARPTR + 2). The screen string will start at the cursor location. An input routine similar to the one in Program Listing 3 (lines 220-260) is used.

Be sure to have your program check the cursor location for each line. If it is greater than 16319, PRINT @ 1023, " " to scroll the screen. Then redetermine the cursor location. This prevents the screen from scrolling during input. Scrolling would move your input out of the screen string location.

To further reduce time-consuming string manipulation, exchange pointers instead of strings when moving lines.

By now, your mind is probably running away with ideas for including this method in some of your own programs. Here are a few short applications you may find useful.

#### Saving a Screen Display

Sometimes it is convenient to save the contents of a screen display for recall later in a program. In Listing 2, line 100 is a one line subroutine to save the screen. Line 110 is another oneliner to restore it.

#### Subroutine for String Input

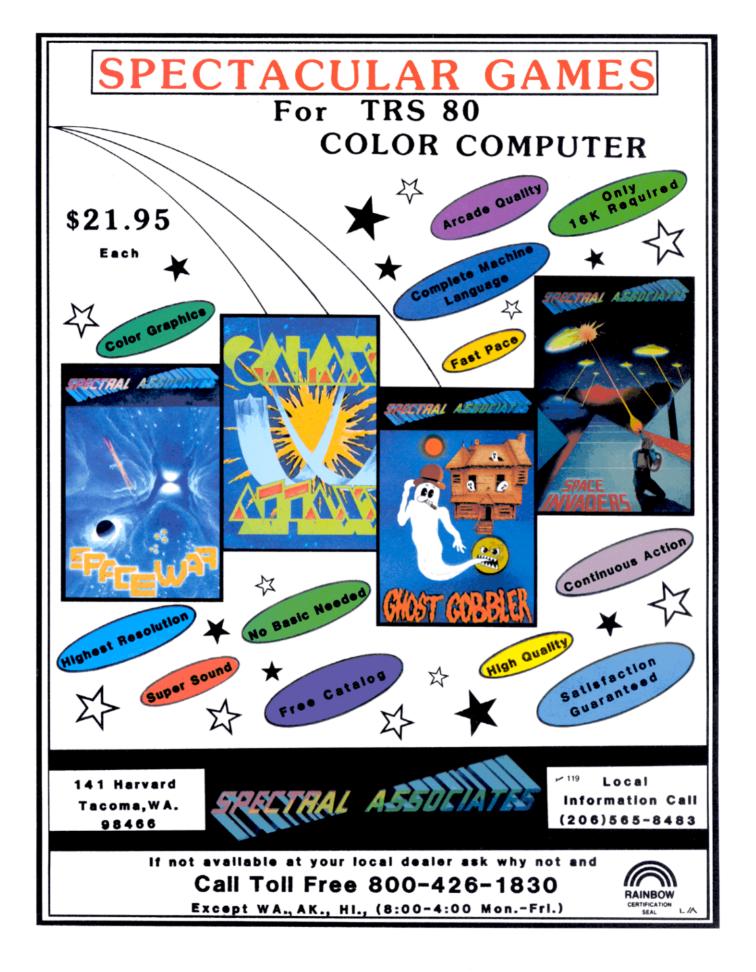
You have a full well-formatted screen. You need an input from the keyboard. But when you press enter at the end of the input, it erases the next line on the screen. Or someone uses a comma or colon in their input; the computer only takes part of the input and prints ?Extra Ignored on the next line. The unemotional computer can ignore this, but it ruined your nice display. Listing 3 lists the essentials of a subroutine to prevent this problem. Now, in programs for things like data management requiring a lot of input, the program will not hang in the middle of a line.

#### Saving Disk Directories in an Array

Program Listing 4 gives a routine for putting disk directories into a string array for NEWDOS or other systems allowing DOS commands from Basic. It is handy for making an index of your programs.

#### A Block of Screen Strings

Program Listing 5 is a short routine for creating a block of screen strings. Its use can save a portion of the screen, compare current screen graphics with the originals, or output selected lines or line segments to a printer.



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```
SUBROUTINE FOR STRING INPUT

( Variables L & S to be supplied by the calling program )

197 'L = MAX. LENGTH OF INPUT STRING
S = SCREEN LOC. ( @ TO 1023 )
SC= SCREEN ADDRESS OF S
SL= LEAST SIGNIFICANT BYTE OF SC
SM= MOST SIGNIFICANT BYTE OF SC
SM= MOST SIGNIFICANT BYTE OF SC
K = COUNT OF STRING LENGTH

199 'M = ADDRESS STORING LEB OF NEXT AVAILABLE SCREEN STOR. ADDR.
MC= CONTENTS OF M
AS= SCREEN STRING
BS=INPUT STRING RETURNED TO THE PROGRAM

200 K=0: AS=": M=16590: V=VARPTR(AS): SC=S+15360: SM=INT(SC/256):
SL=SC-SM*256: POKE V,L: POKE V+1,SL: POKEV+2,SM
210 FOR I=S TO S+L-1: PRINT 0: CHRS(14):: NEXT: PRINTeS,;: MC=PEEK(M)
220 POKE M,MC
230 IS=INNEYS: IFIS="" OR IS=CHRS(10) OR IS=CHRS(26) OR IS=CHRS(27)
THEN 230 ELSE IF IS=CHRS(13) THEN BS=LEFTS(AS,K): RETURN
240 IF IS=CHRS(8) OR IS=CHRS(24) THEN K-K-1 ELSE K-K+1
250 IF K-L PRINT 1S;: GOTO 220
265 IF K-L PRINT CHRS(15) I$;: GOTO 220 ELSE 220
295 '
```

#### Program Listing 3

```
LOAD DIRECTORIES INTO A STRING ARRAY

297 'B$ ARRAY SAVES ENTRIES

A$ = SCREEN STRING

E$ = DISK I.D.

I = ENTRY COUNTER

SL = LEAST SIGN. BYTE OF SCREEN ADDR.

K = GETS LENGTH OF ENTRY

300 CLEAR 4800: CLS: DIM B$(300): A$="": V=VARPTR(A$): POKE V,13: I=-1

310 PRINT"(IF NO MORE DISKS TO BE LISTED, ENTER 'NONE'.)":

INPUTENTER I.D. NO. OF DISK WHICH YOU HAVE INSERTED";E$

320 IF E$="NONE" THEN 370 ELSE SL=100: SM=60: CMD "DIR"

331 I=I+1: SL=SL+20: IF (SL+4)/64=INT((SL+4)/64) THEN SL=SL+4

48 IF SL=255 THEN SL=SL-256: SM=SM+1

350 B$(I) =LEFT$(A$, K-1) +STRING$(I$-K, 32) +ES: GOTO 330

370 REM * B$ ARRAY NOW CONTAINS THE DIRECTORY ENTRIES *

380 RM * PUT SORT ROUTINE HERE *
```

#### Program Listing 4

```
CREATE A BLOCK OF SCREEN STRINGS
397 'S = SCREEN LOCATION OF 1ST STRING (0 TO 1023 )
          L = LENGTH OF STRINGS
N = NUMBER OF STRINGS
480 DIM AS(N-1): SC=S+15296: SM=INT(SC/256): SL=SC-SM*256
418 FOR I= 0 TO N-1: AS(I)=**: V=VARPTR(AS(I)):
SL=SL+64: IFSL>255 THEN SL=SL-256: SM=SM+1
420 POKE V,L: POKE V+1,SL: POKE V+2,SM: NEXT: RETURN
               End of Routines for article
Following are Tests to check out SCREEN STRING Routines
700 ' = = = = TEST FOR SAVE - RESTORE SCREEN ROUTINE = = = =
710 CLEAR1208: CLS: S=15423

' Fill The Screen
720 FOR I= 65 TO 80: PRINT STRINGS(63,I);: POKE S,I: S=S+64:
IF I<80 PRINT: NEXT ELSE NEXT
725 GOSUB 180: S=459: FOR I=1 TO 380: NEXT
730 FOR I=6 TO 2: PRINTE 1=644-S,STRINGS(40,32);: NEXT
740 PRINTE 529, "PRESS ENTER TO CLEAR SCREEN";:INPUTE
' Restore The Screen
750 CLS: PRINTE 529, "PRESS ENTER TO RESTORE SCREEN";:INPUTE
 768 FOR I=1TO 488: NEXT: PRINT@384,;CHR$(200);:PRINT@384,;: END 795 '= = = = = TEST FOR STRING INPUT = = = = = = 888 CLEAR 588: CLS: P=512
800 CLEAR 500: CLS: P=512
805 PRINTPP,CHR$(31);
810 INPUT'INPUT SCREEN LOCATION (512 TO 1000)";S
820 INPUT'MAX. LENGTH OF INPUT STRING";L
822 IF S+L+7 >1023 PRINT"RUNS OFF BOTTOM OF SCREEN.": GOTO 810
825 PRINTPP,CHR$(31);
830 PRINTPS,"INPUT: ";: S=S+7: GOSUB 200
840 PRINT CHR$(15);: N=N+1: PRINT@ N*64,"BS="CHR$(34)B$;CHR$(34);: GOTO805
  875 REM TO TEST DISK DIRECTORY ROUTINE, ADD LINE 390 FOR J=0 TO I: ? B$(J
  895 '= = = TEST FOR BLOCK OF STRINGS = = = =
 900 CLEAR1000:CLS:INPUT*LOCATION OF 1ST STRING (0 TO 1023)*;S
910 INPUT*LENGTH OF STRINGS*;IN
920 INPUT*NUMBER OF STRINGS*;N
925 DIMBS(N):CLS:PORI-65T070:FORJ-0T063STEP4:PRINTUSING*001 ";J;CHR$(I);:NE
  XT: NEXT
 927 INPUT*PRESS ENTER TO PRINT BLOCK OF STRINGS*; Z
936 GOSUB486:PORI=8TON-1:B$(I)=A$(I):NEXT
948 CLS:FORI=8TON-1:PRINTB$(I):NEXT
                                                            Program Listing 5
```

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### How they work for Fortran and Basic.

## Boolean Logic Operators

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he Level II Basic reference manual mentions only briefly that numeric variables (integer, single precision and double precision) can be used like Logical Fortran variables and how If . . . Then statements work. I

shall deal with the more understandable Fortran Logical variables before proceeding to their Level II Basic equivalent. References to Fortran apply specifically to WATFIV-S, although they are true for most versions.

A Logical variable can receive two different values (representing true and false) because of some logical operation. Figure 1 gives examples of Logical variable assignment statements in Fortran and their Level II Basic equivalents.

An assigned Logical variable can replace a logical expression (see Fig. 2). Program Listings 1 and 2 demonstrate Logical variables. In both sample programs the variable name Finish replaces a logical expression after the keyword If. If the variable Finish contains a value representing false, the program will skip the rest of the If...Then statement.

The sample Basic program is like a Fortran program, but with minor differences. Fortran programs must define any variables in the first non-comment pro-

The Key Box

Basic Level II

culiar default rule assigns a type to each undefined variable so that it is best to define all variables. A Logical variable separates

gram lines. Logical variables

must have their own definition

statements. Read and Print

statements usually have an ac-

companying Format list. The pe-

the evaluation of some logical expression from the If...Then statement or statements where it would normally appear. You might wish to set a flag for later, or to test the same condition in several places in your program. Evaluate the common condition in a subroutine and store the result in a Logical variable, saving typing and memory space.

Level II Basic returns a - 1 for a true logical expression and 0 for a false one. In an If...Then statement, when the computer reaches the end of the logical ex-

FORTRAN

P = .TRUE

Q = .FALSE.

P. Q. and R are LOGICAL variables

R = (.NOT, P) .OR. (P .AND. Q)

```
EACH STUDENT. A NEGATIVE ID NUMBER IS USED TO INDICATE
С
   THE END OF THE DATA
    REAL INDAVG
    INTEGER IDNUM, SCORES(5), I, SUM
    LOGICAL FINISH
  5 READ 10, IDNUM, SCORES
 10 FORMAT (I6, 5(1X,I3))
    FINISH = (IDNUM .LT. 0.0)
    IF (FINISH) GO TO 40
    SUM = 0
    DO 20 I = 1, 5
```

THIS PROGRAM READS STUDENT ID NUMBERS AND TEST SCORES

WHICH RANGE 0 TO 100) AND PRINTS AN AVERAGE SCORE FOR

SUM = SUM + SCORES(I) 20 CONTINUE INDAVG = FLOAT(SUM) / 5.0

PRINT 30, IDNUM, SCORES, INDAVG 30 FORMAT (' ', 'STUDENT NUMBER: ', 16, ' FIVE TEST SCORES',

+ ': ', 5(1X,i3),' AVERAGE OF THESE TEST SCORES: ', + F3.2)

**GO TO 5** 40 STOP

Program Listing 1. Sample Fortran program.

Models I or III Legal assignment of a Value to a LOGICAL Variable LEVEL II BASIC equivalent to P# = -1Q! = 0

R% = (NOT P#) OR (P# AND Q!)

Fig. 1. Legal assignment of a value to a Logical variable.

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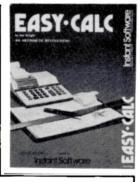
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Level II Basic	Fortran							
equiv	valent to							
P# = -1	P = .TRUE.							
Q! = 0	Q = .FALSE.							
R% = (NOT P#) OR (P# AND Q!)	R = (.NOT. P) .OR. (P .AND. Q)							
	P, Q, and R are LOGICAL variables							
Level II Basic	Fortran							
equiv	valent to							
IF A = A THEN	IF A = A THEN							
IF - 1 THEN	IF (.TRUE.) THEN							
IF NOT 0 THEN	IF (.NOTFALSE.) THEN							
Q% = -1: IF Q% THEN	Q = .TRUE.							
	IF (Q) THEN							
Q% = 87: IF Q% THEN	Q = .TRUE.							
	IF (Q) THEN							
Fig. 2. Tests white	ch are always true.							

IF P# THEN...
IF Q! THEN...
IF Q! THEN...
IF R% THEN...
IF R% OR Q!) AND NOT (R% AND Q!) PRINT "R XOR Q IS TRUE."
IF A%(3) THEN...
IF IN\$ = "Y" and P! THEN...
P! = 21: Q! = 16: IF P! AND Q!, ...'ALWAYS TRUE
P! = 64: Q! = 128:IF P! AND Q! THEN... 'ALWAYS FALSE
IF A + 9 THEN...'FALSE ONLY IF A = −9

Fig. 3. Additional examples of using Logical variables in Level II Basic.

- 10 REM THIS PROGRAM READS STUDENT ID NUMBERS AND TEST
- 20 REM SCORES (WHICH RANGE FROM 0 TO 100) AND PRINTS AN
- 30 REM AVERAGE SCORE FOR EACH STUDENT. THE END OF THE
- 40 REM DATA IS INDICATED BY A NEGATIVE ID NUMBER.
- 50 CLEAR 0: DEFINT A-Z: DIM SCRE(4)
- 60 READ IDNUM!: FOR I = 0 TO 4: READ SCRE(I): NEXT
- 70 FINISH = (IDNUM!<0)
- 80 IF FINISH GOTO 160
- 90 SUM = 0
- 100 FOR I = 0 TO 4
- 110 SUM = SUM + SCRE(I)
- 120 NEXT
- 130 INDAVG! = CSNG(SUM) / 5.0
- 140 PRINT USING "STUDENT NUMBER: ###### FIVE TEST SCORES: "; IDNUM!;; FOR I = 0 TO 4: PRINT USING " ###"; SCRE(I);; NEXT: PRINT USING " AVERAGE OF THESE TEST SCORES: ###.##"; INDAVG!
- 150 GOTO 60
- 160 END
- 170 DATA 123456, 97, 78, 84, 76, 89, 654321, 79, 80, 91, 83, 100, -1, 0, 0, 0, 0

Program Listing 2. Level II Basic version of Fortran sample program.

pression (indicated by a "," a ":", the conventional "Then," or the beginning of another Basic statement), it compares the result of the evaluation to 0. If it is 0 (indicating a false expression) the computer scans for the keyword Else and, on locating it, executes any following statements. If Else is absent in that line the computer moves to the next program line.

All Level II needs is 0 stored in a register upon reaching the end

of a logical expression after the keyword If. A number, numeric variable or complex arithmetic statement can replace a logical expression (see Figs. 2 and 3).

These techniques should work in other Microsoft versions of Basic, perhaps not with Pocket Computer Basic.

The author is currently a junior at Illinois State University majoring in Physics.

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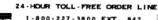
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### The screen stops when full.

## Scroll Your Listings

Mark C. Paxton 4056 Three Oaks Boulevard Troy, MI 48098

The assembly program presented here changes the way LIST functions on your non-disk Level II TRS-80: When you enter the List command, the screen fills with source lines of any Basic program resident in memory, and stops once the screen is full—it does not spin madly past you.

To continue viewing the program listing one line at a time, press the up arrow key for each new line desired. If you wish to scroll backward one line at a time, press the down arrow key.

#### **Using the Program**

Key the source code in Program Listing 1, using an editor/

The Key Box

Basic Level II Model I 16K RAM Printer Optional assembler, and create a system tape named SCRS. Set the memory size to 32540 and load the system tape. When the program stops loading, control transfers to the ready mode, from the system mode.

At this point you can either CLOAD or key in a Basic program. When you execute the LIST command the screen fills with lines; listing will stop when the screen is full. The machine then waits for your input—however, it recognizes only the up or down arrows. To break out of this mode before listing has completed, repeatedly hit the up arrow key and the Break key at the same time until the break is recognized.

To switch between normal LIST mode and the modified LIST mode, key in the SCRS command, or the SCROFF command, in normal command mode as illustrated below:

> >SCRS > >SCROFF

SCRS (SCRoll Screen) causes the LIST command to scroll one line at a time. SCROFF (SCRoll OFF) returns the LIST command to its normal operating mode.

#### Analysis of the Program

The program takes advantage of three DOS exits: 41E2H, 41B2H, and 41DFH.

The DOS exit at 41E2H is called from the System command routine (at 02B2H). The SCRS program uses it to pass control back to the Basic ready mode, once it has completed loading.

The DOS exit at 41B2H is part of the ready routine which starts at 1A19H, 41B2H is called from 1A1CH. At this point, you have already made a keyboard entry which has been compressed to space compression codes wherever possible. Therefore, this DOS exit is used to slip out and check the input buffer for the entry of a new command: SCRS or SCROFF. If you do not enter either of these commands, control returns to Basic and no harm is done. If you enter either SCRS or SCROFF, then you execute the appropriate routine in the program to activate or deactivate the modified LIST mode.

The DOS exit at 41DFH is part of the LIST/LLIST command routine logic. LIST starts at 2B2EH, and LLIST starts at 2B29H. The two commands use the same code. However, between 2B29H and 2B2EH, the output device type indicator (located at

409CH) gets set to 01, which indicates the printer. (The default code is zero, for video. A minus 1 means the cassette.) The call to 41DFH is made from 2B44H; it is called once before each line is displayed.

If you have a line printer on your system, put a check in the SCRS program to see if the output device type indicator (at 409CH) contains an 01H. If it does, you can return immediately to Basic to avoid problems. It is not necessary that you do this however; the only adverse effect is that the screen clears every time you enter LLIST.

The program in Listing 1 is not very large considering the functions it performs. This is due largely to the use of numerous ROM routines to perform general tasks. A short study of the listing itself will prove beneficial and may add new ROM routines to your own repertoire.

Mark Paxton, a professional programmer and systems analyst, also teaches Cobol parttime.

		Program	Listing	
41E2 SYSTEM CMD	80819	ORG	41E2H	; SET UP AUTOSTOP OF
41E2 C3AF7F	88828	JP	AUTO	
41B2 TEST BUFFER	00030	ORG	41B2H	;SET UP USER EXIT TO
				Listing continues

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Attn: Debra Boudrieau

Listing continued	1			
41DF	00040 00050		JP ORG	USEXIT 41DFH ;EXIT 'LIST' CMD
41DF C31C7F	00060 00070	:******	JP	SCRS
	00080 00090	; * PROGR ; * MAINT	AM=====: -DATE==:	==> SCRS
	00100 00110	; * AUTHO ; * DESCR	R=======	==> M.C.PAXTON * ==> SCROLL UP *
	00120 00130	; * OR DO	WN OF B	ASIC LISTINGS *
7F1C 7F1C D5	00140 00150	SCRS	ORG PUSH	32540 ;SET MEMSIZE TO THIS DE ;LINE DELIMITER
7F1D C5 7F1E E5	00160 00170		PUSH PUSH	BC ; NEXT LINE PTR HL ; PTR TO LINE #
7F1F 2B 7F20 2B	00180 00190		DEC	HL HL
7F21 EB	00200 00210		EX	DE,HL ;DE=PTR TO BEGIN ; OF LINE (PTR TO
7F22 2AA440	00220 00230		LD	; NEXT LINE) HL,(40A4H) ;BEG OF BASIC
7F25 B7 7F26 ED52	00240 00250		OR SBC	A ; CLR CARRY HL, DE
7F28 2003 7F2A CDC901	00260 00270		JR CALL	NZ, CONT ; NOT FIRST LINE 01C9H ; CLS ON 1ST LINE
7F2D ED5B2040	00280		LD	DE, (4020H) ; DE=CURSOR P
OSITION 7F31 21803F	00300		LD	HL,3F80H ;HL=DELIMITE
R LINE ADDRSS 7F34 B7	00310		OR	A ; CLEAR CARRY
7F35 ED52 BOTTOM OF SCR	00310		SBC	HL, DE ; CHECK TO SEE IF AT
7F37 FA3E7F AT BOTTOM	00330		JP	M, KBSCAN ; JUMP TO KBSCAN IF
	00340 00350	;====-	SCROTT	SCREEN FORWARD ROUTINE <=====
7F3A E1 RESET REGS	00350 00360		POP	SCREEN FORWARD ROUTINE (=====  HL ; UP SCREEN ROUTINE (
RESET REGS	00370			; AND GOBACK FRON WHE
NCE WE CAME) 7F3B Cl 7F3C Dl	00380 00390		POP	BC DE
7F3C D1 7F3D C9	00390 00400		POP RET	DE
7F3E CD2B00	00410 00420	KBSCAN	CALL	2BH ; KEYBOARD SCAN ROUTINE -
LOOK FOR	00430			;UP ARROW ENTRY OR DOWN ARRO
W ENTRY.	00440			; IGNORE EVERYTHING ELSE
7F41 B7 7F42 28FA	00450 00460		OR JR	A 2,KBSCAN
7F44 FE5B	00470 00480		CP	5BH ;UP ARROW
7F46 28F2	00490 00500		JR	Z,UP
7F48 FEØA 7F4A 2804	00510 00520 00530		JR	ØAH ;DOWN ARROW Z,DOWN
7F4C 18F0	00540	TSTSCR	JR DEFS	KBSCAN 2
0002 7F50 AF		;====>		DISPLAY ROUTINE <===== A
7F50 AF 7F51 F5 7F52 21C03F	00580 00590		XOR PUSH LD	A AF HL,3FCØH
7F52 21C03F 7F55 224E7F CTR FOR # OF	00600		rd rd	(TSTSCR), HL ; SET A=0. A IS
OVER. SET	99610			; LINES ON SCREEN TO BACKUP
NE OF SCREEN.	00620		6-	; TSTSCR VARIABLE TO LAST LI
7F58 B7 7F59 114000	00630 00640		OR LD	A ;CLEAR CARRY DE, 40H
7F5C 2A4E7F RESS	00650		LD	HL, (TSTSCR) ; HL=LINE ADD
7F5F ED52 ADDRSS	00660		SBC	HL,DE ;CALC NEW SCRN LINE
7F61 224E7F XT TIME	00670		LD	(TSTSCR),HL ;SAVE FOR NE
7F64 CD5A1E O DE IT GOES)	00680 00690		CALL	1E5AH ; CONVRT TO HEX (INT
7F67 7A 7F68 B3 O LINE #	00690 00700		LD OR	A,D E ;NZ=LINE * THERE,Z=N
7F69 2005 7F6B F1	00716 00720		JR POP	NZ,CONT2 AF
7F6B F1 7F6C 3C TO BACKUP	00720 00730		POP INC	A ;INC CTR FOR # LINES
7F6D F5 7F6E 18E8	00740 00750		PUSH JR	AF ;SAVE CTR (IN A) AGN2 ;DO IT AGAIN
7F70 21003C R 1ST LINE	00760	CONT2	LD	HL,3C00H ;LOAD ADDRESS OF SC
7F73 CD5AlE 7F76 CD2ClB	00770 00780		CALL CALL	1E5AH ;DE=HEX LINE # ON RET 1B2CH ;BC=PTR TO NEXT LINE P
TR	00790			; ON RETURN
7 <b>F</b> 79 5 <b>0</b> 7 <b>F</b> 7 <b>A</b> 59	00800 00810		LD LD	D,B E,C ;DD = BC
7F7B 2AA440 OF BASIC TEXT	00820 00830		LD	HL,(40A4H) ;HL=BEGIN ADDRSS
OF BASIC TEXT 7F7E E5	00840 00850		PUSH	HL
7F7F 44 7F80 4D	00850 00860 00870	TEST	LD	B,H C,L
788 4D 7881 B7 7882 ED52	99889 99899		OR SBC	A HL,DE
7F84 El 7F85 280C	00900 00910		POP JR	HL 2,DONE
7F87 C5	00920 00930		PUSH	BC
	00940 00950		POP LD	IX L,(IX)
				Listing continues

Listing continue	d		
7F8D DD6601 7F90 C5 7F91 18EC	00960 00970 00980	LD PUSH JŘ	H,(IX+1) BC TEST
7P93 F1	00990 01000 DONE	POP	AF ; RETRIEVE COUNTER IN A RE
G. 7P94 47 7F95 B7	01010 01020	LD OR	B,A A
7F96 78 7F97 2807	01030 01040	LD JR	A,B Z,AROUND
7F99 DDE5	01050 01060	PUSH	IX ; PUT ADDRESS OF PREV
LINE PTR 789B Dl ER PAIR	01070	POP	DE ; INTO THE DE REGIST
7F9C 3D 7F9D F5	01080 01090	DEC PUSH	A AP
7F9E 18DB 7FAØ 4E	01100 01110	JR	AGN
7FAB 4E IN PLACE 7FAL 23	01120 AROUND 01130	INC	C,(HL) ; PUT EVERYTHING BACK
7PA2 46 7PA3 23	01140 01150	LD INC	B, (HL) HL
7FA4 E5 7FA5 C5	01160 01170	PUSH	HL BC
7FA6 CDC901 7FA9 Cl 7FAA El	01180 01190 01200	POP POP	#1C9H ;CLS BC HL
7PAB D1 7PAC D1	01210 01220	POP POP	DE DE
7FAD D1 OM STCK	01230	POP	DE ;DE=DELIMITER LINE NO. PR
7PAE C9 7PAP 3EC9	01240 01250 01260 AUTO	RET LD	A,9C9B
7FB1 32E241 7FB4 21191A	01270 01280	LD LD	(41E2H),A HL,1A19H
7FB7 E3 7FB8 C9	01290 01300		(SP),HL GO TO 1A19H <ready></ready>
*********			CHECK INPUT BUFFER FOR SCRS/SCR
OFF ENTRY *			ABOR INFOT BUFFER FOR SCRS/SCR
7PB9 53	01340 CMDLI1		'SCRSSCROFF'
7PC3 E5 7PC4 Ø8 7PC5 D9	01350 USEXI1 01360 01370	PUSH EX EXX	HI.; SAVE DUFFER POINTER AF,AF'; SAVE REGISTERS ; SAVE REGISTERS
7PC6 El Fer	01380	POP	HL ; RETRIEVE PTR TO BUF
7FC7 D7 COMMAND ENTRY		RST	18H ; LOCATE 1ST BYTE OF
7FC8 2B D ENTRY 7FC9 E5	01400 01410	DEC PUSH	HL ; POINT BEFORE COMMAN  HL ; SAVE POINTER
7FCA 11B87F	01420 01430	LD	DE,CMDLIT-1 ; POINT TO LITERA
LS - 1 7FCD 0604	81440	LD	B,4 ; LOAD 1ST COMMAND LE
NGTH 7PCF CDE27F 7FD2 2817	01450 01460	CALL JR	CMDTST ; IS IT <scrs>? Z,SCRON ; GO-IF YES</scrs>
7FD4 El 7FD5 0606	01470 01480	POP LD	HL B,6 ; LOAD 2ND COMMAND LE
NGTH 7FD7 11BC7F ITERAL	01490	LD	DE,CMDLIT+3 ; POINT TO NEXT L
7PDA CDE27F 7PDD 2813	01502 01510	CALL JR	CMDTST ; IS IT <scroff>? 2,SCROFF;GO-IF YES</scroff>
7PDF 08	01520 01530 GOBACI	K EX	AF, AF' ; REPLACE THE ORIG RE
GS 7 <b>PEØ</b> D9 7 <b>FE</b> l C9	01540 01550	EXX RET	
7FE2 23	01560 01570 CMDTS	r inc	HL
7FE3 13 7FE4 1A AL	01580 01590	I NC LD	DE A,(DE) ;GET BYTE PROM LITER
7FE5 BE ORRESPONDING	01600	CP	(HL) ; DOES IT MATCH THE C
ED IN THE	01618		BYTE THAT WAS ENTER
7FE6 2002	01620 01630	JR	;BUFFER AREA? NZ,NOPE ; IF NOT, THEN GET OUT
7FE8 10F8 E	81640	DJNZ	CHDTST ; MATCH-TEST NEXT BYT
7PEA C9	01650 NOPE 01660 ;*****	RET	;Z=POUND, NZ=NOT POUND
7FEB 3EC3	91679 ;* SCI 91689 ;**** 91699 SCRON	LD	INE * ****** A,0C3H
7PED 32DF41 7FF0 1805	01700 01710	LD JR	(41DFH), A ; ENABLE THE JUMP READY ; GOBACK TO < READY>
	01720 ; ***********************************	ROFF ROUS	TINE *
7FF2 3EC9 7FF4 32DF41	01740 ;***** 01750 SCROP 01760	F LD LD	A,0C9H (41DPH),A ;DISABLE THE JUMP.
RESTORES	01770		THE LIST COMMAND TO ITS ORG
INAL MODE	01780		OF OPERATION.
7 <b>PP</b> 7 21191A SS 7 <b>PP</b> A E3	01790 READY	LD EX	HL, lal9H ; < READY > RTN ADDRE  (SP), HL; STICK IT ON THE STA
CK 7 <b>PFB</b> 18E2	9181Ø	JR	GOBACK ; RETURN TO < READY > R
TN	61829	DND	1 a 1 0 u
1A19 98968 TOTAL	01830 ERRORS	END	1A19H



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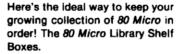


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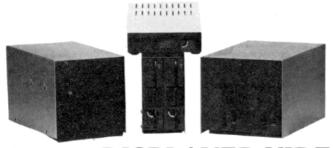
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## APL Primer—Part I

by Margaret M. Grothman

hat's the difference between monadic and dyadic functions? Stay tuned for a description of system commands and variable names.

APL is such a concise and efficient computer language that Basic seems clumsy by comparison. It has built-in functions that let you do with a few keystrokes what would take many program lines in another language. Because of its large library of built-in functions, APL lends itself well to mathematical and statistical applications. Functions not built in can be defined by you and called by name. This, plus its ability to operate on arrays, gives APL its strength.

APL80, written by Phelps Gates and published by Ramware (Milford, NH 03055), is a large subset of the standard APL language, and is available in either 16K cassette or 32K disk versions for the Model I. All the examples here work with the 16K version.

Because the large number of functions exceeds the number of symbols on a normal keyboard, standard APL requires a keyboard with special symbols, such as Greek letters. Since the TRS-80 has no such keyboard, shifted letters represent many special APL symbols.

#### APL as a Calculator

APL has no print or write statement. To print to the screen, type your message in single quotes.

Enter: 'THIS IS A MESSAGE.'

Result: THIS IS A MESSAGE.

Another example is:

Enter: '10 + 11 + 3' Result: 10 + 11 + 3

If you omit the single quotes, APL behaves like a calculator. You are using the execution mode, which is like the command mode in Basic.

APL does not use the dash sign for subtraction. The dash functions as a prefix to indicate a negative number. The sign for subtraction is also a dash, but it is in a lower position and is produced by pressing the clear key.

Enter: 30\_\_12 Result: 18

Enter 30 – 12

Result: SYNTAX ERROR: 30-12

The second example will not execute because APL cannot find an operator. The negation sign indicates only that 12 is negative.

In APL80, you set the symbol for multiplication by pressing the shift key followed by X. It appears on the screen as a small graphics block followed by the letter X. The asterisk, which is the multiplication operator in Basic, is the power function in APL80.

Enter: 10 X 3, Result: 30

Enter: 10\*3

Result: 1000 (10 cubed)

Division requires the percent sign. The slash, used for division in Basic, is used in APL for other functions.

> Enter: 15%3 Result: 5

APL is accurate to six significant digits.

Enter: 3.333333 X 10 Result: 33.3333

Enter: 6.666666 X 10 Result: 66.6667

Only six digits are displayed in the answer, regardless of how many you enter. Also, in the second example the sixth digit is rounded up.

#### **Combined Expressions**

APL has no hierarchy of operations. Expressions are executed in order from right to left. This is one of the hardest features of APL to adjust to because it differs from other programming languages, and from mathematical convention. One reason for the right-to-left rule is that it is easy to remember. APL has so many functions that remembering a hierarchy would be difficult.

Enter: 3 X2 + 12 Result: 42

The result is not the same as the

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## MICRO-80"INC

E. 2665 Busby Road Oak Harbor, WA 98277 1-206-675-6143 Basic or Pascal result, and does not follow accepted mathematical practice, in which multiplication is performed before the addition. Here, 2 is added to 12 first, and the result is multiplied by 3.

You can alter the order of execution by using parentheses. Expressions within parentheses are executed from right to left. The parentheses in the next example force execution of 3 times 2 before adding 12.

> Enter: (3 X 2) + 12 Result: 18

If you evaluate  $8 + 20 \times 2 + 12$ , mathematical convention requires that multiplication be performed before addition, making the correct answer 60. Presenting this task to a Basic interpreter or a Pascal compiler produces the same result. But if you enter APL line  $8 + 20 \times 2 + 12$ , the answer is 288. The right-to-left rule causes execution in this order:

2 + 12 = 14  $20 \times 14 = 280$ 8 + 280 = 288

The result of each operation becomes data for the next operation. If you want the expression evaluated conventionally, use parentheses to execute  $20 \times 2$  before the two addition operations. The equation  $8 + (20_{\,_{\tiny B}} \text{ X } 2) + 12$  produces the mathematically correct answer.

Here are two more examples:

Expression:  $\frac{7 \times 5}{5 \times 10}$ 

Enter: 7 X5%5 X10 Result: .7

Expression:  $\frac{4(3)}{3/15+7}$ 

Enter: 4 X 3 % (3 % 15) + 7 Result: 1.66667

The first example requires no parentheses because the normal right-to-left execution causes no errors. The second example, however, requires parentheses around 3%15 to prevent the 7 from being added to 15 before division takes place. When in doubt, use parentheses; extra ones do no harm.

#### **Monadic Functions**

The terms monadic, dyadic, and niladic describe the number of operands or arguments a function requires. All the functions introduced so far are dyadic: they require one operand before the function symbol

and one after. A monadic function has only one argument, following the symbol. Niladic functions have no operands. None of APL80's built-in functions are niladic.

The absolute-value function is an example of a monadic function. Its symbol is produced by typing shift, J. (In APL80, all symbols preceded by a shift are displayed on the screen with a small graphics block.)

Enter J - 100 (use the negation sign, not the minus),

Result: 100

A monadic function generally shares its symbol with a dyadic function. For example, the dyadic use of shift, J is the residue function, which returns the remainder when division is executed.

Enter: 3 J 16
Result: 1 (3 goes into 16 with a remainder, or residue, of 1).

The residue function can be used to extract the fractional part of a positive number. (In APL80, the residue function doesn't work with negative arguments.)

Enter: 1 J 8.75 Result: .75

Each dyadic arithmetic function has a corresponding monadic function that uses the same symbol. The division symbol % used as a monadic operator produces the reciprocal of a number. (The reciprocal is one divided by the number.)

Enter: %5 Result: .2

The dyadic multiplication function shares its symbol, shift X, with the monadic sign function. This function returns a 1 if the operand is positive, -1 if negative, and 0 if it is zero.

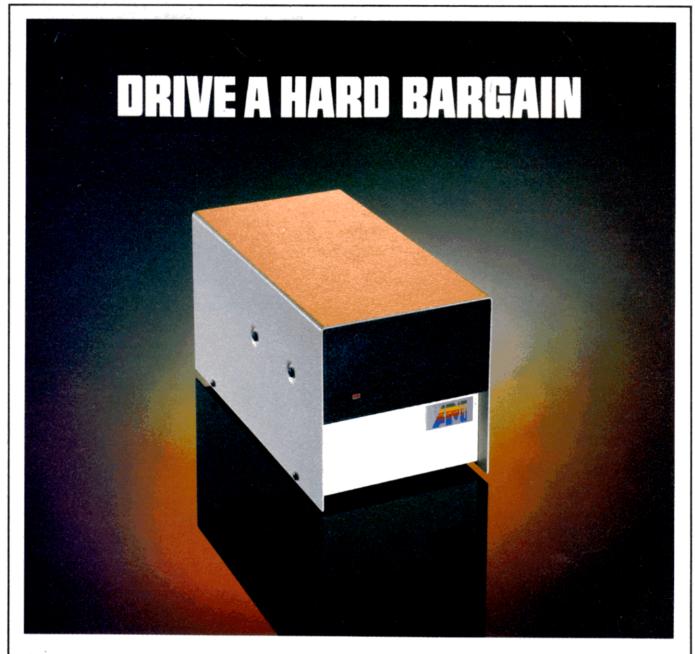
Enter: X5 Result: 1

Enter: X - 5Result: -1

The minus sign (clear key) may be used as a monadic function to change the sign of a number.

Enter: \_2 Result: -2

Another symbol that does double duty as a monadic and a dyadic function is the exclamation point. Monadic! is the factorial function. Remember to put the symbol before the



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argument, not after, as you would in conventional mathematical notation.

Enter: !4

Result: 24 (4 times 3 times 2 times 1)

The dyadic function that uses! is called the combinatorial function. It is used to find the number of combinations of a certain size within a larger number. For example, 3!4 returns 4, the number of combinations of 3 that can be formed out of four objects.

The @ sign is also used for a monadic-dyadic function pair. The dyadic form is used to find logarithms to any base. The first argument is the base and the second is the number. To ask for log 16 to the base 4,

Enter: 4@16

Result: 2 (exponent to which 4 must be raised to

obtain 16).

When @ is used as a monadic function, the natural log is returned. For example, to find the natural log of .7,

Enter: @.7 Result: -.356675

#### Variable Assignments

You may use long variable names in

APL. APL80 will accept names as long as 60 characters. Since using the variable requires typing the entire name, short names are desirable.

Variable names can consist of any combination of letters and numbers, but must start with a letter. Names can contain dashes but not spaces. Assign a variable by typing shift followed by the left arrow.

Enter: NUMBER←15

The value assigned to a variable is displayed when you enter the name. If you type an unassigned name, an error message results.

> Enter: NUMBER Result: 15

Enter: NAME

Result: VALUE ERROR: NAME

Variables are used in expressions in the same way as constants. New variables may be defined in terms of already defined variables.

Enter: VALUE-NUMBER X 3

Enter: VALUE Result: 45 Once a variable is assigned, it keeps its value until assigned another.

Enter: NUMBER←NUMBER + 1

Enter: NUMBER Result: 16

The monadic version of the plus sign is used to transfer the value assigned to one variable to another. It is called the identity function. After the transfer the same value will be assigned to both variables.

Enter:  $V \leftarrow (15*2) + 3 \times 45$ 

Enter: W←+V Enter: W Result: 360

Text material may also be assigned to variables. These are called literals. To assign a literal, type the name in single quotes.

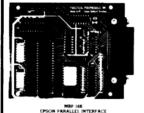
Enter: NAME1←'FOZZY' Enter: NAME2←'BEAR'

Arithmetic operations may not be performed on literal variables.

Enter: NAME3 - NAME1 + NAME2

Result: DOMAIN ERROR: NAME3 - NAME1

+ NAME2



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There is a way, however, to combine literals.

Enter: NAME3-NAME1,NAME2

Enter: NAME3 Result: FOZZYBEAR

Or better yet,

Enter: NAME3~NAME1,",NAME2

Enter: NAME3 Result: FOZZY BEAR

The comma is used to chain variables together. This is the catenation function. It may be used for combining any variables, not just literals.

In the following example, variables are used to convert 10 degrees Celsius to Fahrenheit degrees. The first line assigns the value 10 to the variable name CELSIUS. The second line applies the conversion formula,  $F = 32 + 9/5 \times C$ , and assigns the result to the variable FAHRENHEIT. The last line retrieves the value of FAHRENHEIT computed in the second line.

Enter: CELSIUS←10

Enter: FAHRENHEIT - 32 + (9%5) X CELSIUS

Enter: FAHRENHEIT

Result: 50

This operation could be done in two lines by using the quad symbol in the second line. The quad symbol is usually represented by a little box called a window. In APL80, it is obtained by typing shift, Q. Replace the second and third lines in the above example with  $_{\bullet}Q$   $\leftarrow$  32 + (9%5)  $_{\bullet}X$  CELSIUS.

Quad used in this way causes the value assigned to the variable to be displayed right away, making it unnecessary to enter the variable name separately. You will be seeing the quad function later in another use.

Although this example illustrates the assignment and use of variables, it is an awkward way of doing the job. To apply the formula to a different value of CELSIUS would require retyping the lines. There is a better way.

#### An APL80 Program

A more efficient way of converting Celsius temperatures to Fahrenheit is to define a function that can be called by name. Until now, we have done everything in execution mode. To create your own functions in APL, you must be in the definition mode. The system command )DEF takes you to that mode.

To avoid typing long names when the function is used, I've shortened FAHRENHEIT and CELSIUS to

FAHREN and CEL. You do not have to type the line numbers; they are done automatically in the definition mode. This function consists of only two lines: the title line and line 1. When line number 2 is presented, press break to exit from the definition mode.

> **DEF FAHREN** 1: 32 + (9%5) X CEL 2: break

To call the FAHREN function, assign a value to CEL, then type and enter the function name.

> Enter: CEL←5 Enter: FAHREN Result: 41

This is a niladic function, one with no arguments. Later you will write this function as a monadic function, in which the value of CEL need not be entered separately first.

Try using FAHREN once more. This time assign seven values to CEL, each separated by a space.

Enter: CEL ← - 15 - 10 - 5 0 5 10 15

Enter: FAHREN Result: 5 14 23 32 41 50 59

You have assigned a series of values to CEL. The variable CEL is now a vector, similar to a one-dimensional array in Basic. No dimension statement is required; dimensioning is done automatically in APL. You need only write an assignment line with the desired values following the left arrow, separated by spaces. When FAHREN is called, the defined operations are performed on each member of the vector.

You have written an APL program. APL programming is just writing userdefined functions.

#### **Another APL80 Program**

A defined function need not be restricted to one formula as in FAHREN. The function CONE defined below computes the base area and the volume of a cone when its height and the radius of its base are assigned to HT and RAD. Again, short variable names are used to avoid the tedium of typing long names. To use CONE, assign values to RAD and HT, then type CONE.

DEF CONE

1: 'THE AREA OF THE BASE IS'

2:  $3.1416 \times X \text{ RAD * 2}$  3: 'THE VOLUME OF THE CONE IS'

4: (3.1416 % 3) X (RAD\*2) X HT

Enter: RAD←1 2 3 Enter: HT←1 2 3 Enter: CONE

Result: THE AREA OF THE BASE IS 3.1416

12,5664 28,2744

THE VOLUME OF THE CONE IS 1.0472

8.3776 28.2744

Like FAHREN, CONE requires that its variables be defined in advance. Also like FAHREN. CONE can be rewritten to avoid the separate assignment statements. Since CONE has two arguments, it will be rewritten in Part II of this series as a dyadic function.

It is possible to assign a single value to one variable and a vector to the other. In this way you can determine the effect of holding one variable constant while varying another.

Enter: RAD←2 Enter: HT-456 Enter: CONE

Result: THE AREA OF THE BASE IS 12.5664 THE VOLUME OF THE CONE IS 16.7552

20.944 25.1328

#### Other System Commands

The definitions of several APL80 commands mention the word "workspace." In APL, workspace refers to the area of memory in which assigned variables and defined functions are stored. Work in progress can be stored and retrieved by saving and loading the workspace.

All system commands are preceded by a right parenthesis.

- )CLEAR erases all the assigned variables and defined functions from memory. In APL jargon, you have cleared the workspace.
- )FNS lists the names of all the functions defined in the workspace.
- )VARS lists all variable names that have been assigned.
- )SAVE saves the workspace to tape.
- )LOAD loads a saved workspace from tape.
- )CHECK is used to verify a saved workspace.
- )ERASE removes a function or variable from the workspace. The function or variable name follows the word ERASE.
- )EDIT allows you to make changes or insertions in a named function. The edit function will be described next month.
- )OFF clears APL80 from memory and returns you to Level II Basic.

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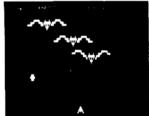
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6#9 767-2751
 312 PRINTCHR$(23):PRINT@9,"I see you are using a "+AM$;:FORAT=1T
Ol000:NEXT:CLS
314 INPUT What line No. is the string you want to change in ";AL
316 Al=PEEK(AS):A2=PEEK(AS+1):A3=PEEK(AS+2):A4=PEEK(AS+3)
318 A9=A3+A4*256
328 IFA9=ALTHENCLS:PRINT"I have found line No. ";AL:GOTO324ELSEC
LS:PRINT"I am looking at line No. ";A9
322 IFA9:ALITHENAS=Al+A2*256:GOTO316ELSEIFA9>ALTHENPRINT"I can no
t find that line. Please check your input.":PORZZ=1T01000:NEXT:C
LS:COTTO316
 1324 AS-AS:PRINT"It starts in memory location No. ";AS:PRINT"----
 328 PRINTPEEK(AS);:AS=AS+1:AJ=AJ+1:IFAJ<4THENGOTO328ELSEIFPEEK(A
338 PRINT:PRINT | PRINT | This is the computer code for the line." | PRINT | The first two numbers (n1+n2*256) = start address of next
 line."
332 PRINT"The next two numbers (n3+n4*256) = present line number .":PRINT"The remaining numbers are the ASCII & Internal Codes for the ":PRINT"program line.":INPUT"Press 'ENTER' to continue.";ZZ
 :CLS
334 PRINT*Press the up arrow to go to next higher memory locatio
n.*:PRINT*Press the down arrow to go to next lower memory locatio
n.*:PRINT*Press 'C' to change the present memory location.*:PRI
NT*If 'C' is pressed you type in the new Code No. & press 'ENTER
NT*If 'C' is pressed you type in the new Code No. & press 'ENTER
 336 PRINT"As you change each memory location you will be shown w hat":PRINT"is in the next location. Be careful not to change so mething "!PRINT"outside of the string parenthesis. Press 'BREAK' to escape."

337 A8-A8-AJ
 338 PRINT*Nemory location*, A8; = "; PEEK(A8), "ASCII = "; 348 IFPEEK(A8))=32ANDPEEK(A8)<=191THENPRINTCHR$(PEEK(A8))ELSEPRINT*Computer code" 342 GOSUB398:GOTO338
  350 PRINT For introduction press 'I' any other key to start. ":GO SUB390:IPAKEY$<>"I"THENGOTO316ELSECLS
  352 PRINT Using poke graphics can add fast graphics to a BASIC p
   First you make up dummy strings. Example >> GR$=";CHR$(34);"0123456789";CHR$(34);"
  Next you poke a graphics character code into each memory"
354 PRINT location. Then when the string is printed in the progr
  then graphics will appear on the screen. In this example if
we poke graphics character '191' into each location between
 we poke graphics character '191' into each location between
the parenthesis when GRS is printed we will see ";
356 PRINTSTRING$(18,191);"
printed. >>Press any key for program";:GOSUB398:CLS:GOTO318
365 GOTO3165
398 AKEY$-INKEY$:IPAKEY$=""THEN398
392 IPASC(AKEY$)=91THENA8-A8+1
394 IPASC(AKEY$)=91THENA8-A8+1
396 IPASC(AKEY$)=67ORASC(AKEY$)=99THEN398ELSERETURN
398 INPUT*New code";AN:POKEA8;AN:RETURN
```

Program Listing

James S. Schaefer 33 Jackson Road Berlin, NJ 08009

POKE Graphics add high speed displays to a Basic program.

The first two memory locations of each line store the starting address of the next line. To find the start address of the next line use the formula n1 + n2\*256. The next two memory locations store the present line number. To find the present line number use the formula n3 + n4\*256. Control, text characters and space compression codes combine to store the rest of the lines. A zero ends each line and tells the computer to go to the next line or end the program.

To create POKE graphic string(s) first make up dummy string(s) to change into graphic strings(s). Begin the program with these strings because the computer must "see" the graphic string(s) before they are

printed.

The POKE Graphics program starts at line 300, leaving enough room for any graphic display you put in your program. For example, start a 15 character dummy string in line 10 by writing 10 G1\$ = "123456789012345" To change this into a graphic string find the memory locations and POKE the new graphic codes into the locations now storing 123456789012345

You can use the POKE Graphics program when you have keyed in line 10 as above.

Line 310 PEEKs location 293 to see if the program is in a Model I or Model III. A 73 stored in this location indicates Model III; any other indicates Model I. You are then informed of this in line 312. Line 310 also sets AS (address start) equal to the memory address of the beginning of the Basic program by using the pointer at addresses 16548 and 16549. This makes the program compatible with both the Model I, the Model III and Disk Basic. Line 314 asks what

```
Memory location
                   ##### = 71
                                  ASCII = G
Memory location
                   ##### = 49
                                  ASCII = 1
                   ##### = 36
                                  ASCII = $
Memory location
                   ##### = 213
                                  ASCII = Internal Code
Memory location
Memory location
                   ##### = 34
                                  ASCH = "
Memory location
                   #### = 49
                                  ASCII = 1
                      Table 1
```

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line and AL (associate line) holds the line number.

A1 holds the least significant byte and A2 holds the most significant byte for the memory location of the next line. (Remember n1 + n2\*256.) A3 holds the least significant byte and A4 holds the most significant byte for the present line number. (Remember n3 + n4\*256.)

Line 318 makes A9 equal to the present line number (A3 + A\$\*256), If A9 equals AL then you have the line number you need and A0 = AS. A0 is the memory location for the line you need. Line 328 prints the ASCII and control codes to check for the dummy string. AJ records the number of memory locations the line uses so that after the code is printed you can return to the beginning of the line in memory. If the line found does not equal the line you need A9 is set to equal the start of the next line in memory. This continues until the line is found or there are no lines left.

You can now step through memory locations searching for the 123456789012345 you want to change. The up arrow steps up in memory; the down arrow steps down in memory. Press the up arrow until you see the contents of Table 1.

Now you can change the 1 stored here into a graphics code. Press C and answer the question New code? with a graphics control code between 128 and 191. After you change this memory location you will see the new code. If you change the 1 into graphic code 191 the screen will show:

Memory location ##### = 191
ASCII = ■

If you wanted this, press the up arrow to move to the next higher memory location. If not, press C to change the code stored in the memory location. Remember that if you change one outside of the quotation marks you could destroy your program. Be careful!

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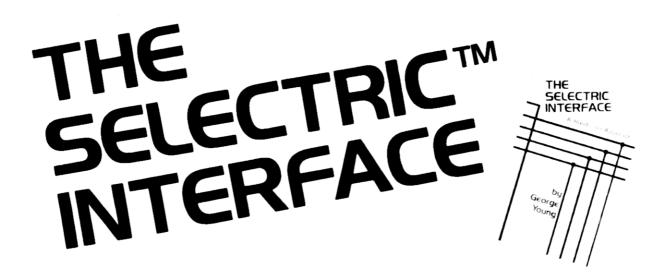
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## **Easy Picture Editor**

by Ron Ginger

The TRS-80 Color Computer provides some great graphics commands that make graphics programs easy for the novice programmer—easy, but tedious. All graphics require x and y coordinates and some require several arguments. Keeping the arguments straight and getting the right coordinates takes careful work and much patience. Drawing the picture on graph paper helps keep things organized, but it's hard to see exactly what the screen will look like until you type in the entire program.

I use a GIGI color graphics terminal connected to a VAX 11/780 at work and have access to some powerful

### imple commands for Dart or game graphics: lines, boxes, and circles for the Color Computer.

graphics editor software that lets me generate picture files by simple menudriven keypad commands. I discovered that the same capability was possible for the Color Computer.

The program lets you create a drawing with simple keyboard commands and then save a tape file, in Basic program format, that can be loaded and run to draw your picture. You can use this program to create a display or as the basis of a game program.

Operation is simple. The text screen displays all possible commands and arguments. A blinking cursor appears in the first display column which you move up and down with the arrow keys. When the cursor is in front of the item you want to draw, press enter. If the command requires more arguments, the cursor will jump to the appropriate place and await your entry.

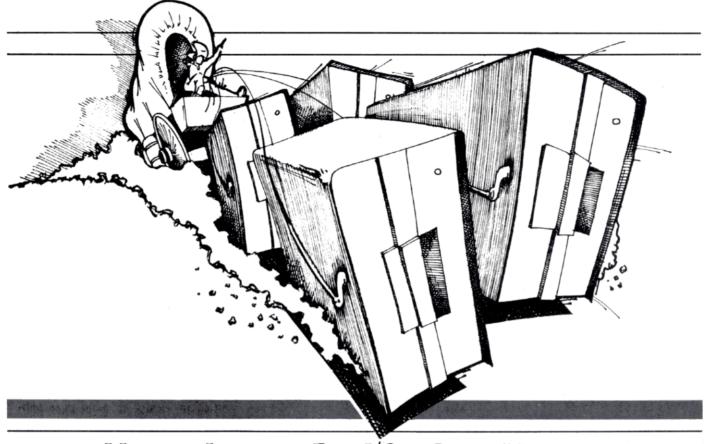
Once you have selected an object to draw, the graphics screen displays a single dot. Each arrow key moves this marker one pixel in the corresponding direction. With shift and an arrow, the marker moves 10 pixels. When the marker is where you want it, press enter. For lines, place the marker at the beginning of the line, press enter, move the marker to the end of the line, and press enter again. A line will be drawn between the selected points. You can continue to select and enter points as needed.

Boxes are entered in a similar manner. You move the marker to one box corner, press enter, move it to an opposite corner, and press enter again. For circles, first select the center, then a point of the circumference. Pressing an incorrect key returns the text screen for another command input.

The Key Box

**Color Computer 16K RAM Extended Color Basic** 

```
Program Listing
  REM *
  REM *
          PICTURE EDITOR
3 REM *
         BY RON GINGER
4 REM * VER 1
                 JAN 9 1982
5 REM ********
10 CLEAR 1000:PMODE 3,1:PCLS:DIM L$(50)
15 D$=CHR$(94) +CHR$(9) +CHR$(10) +CHR$(8) +CHR$(95) +CHR$(93) +CHR$(9
1) + CHR$(21)
20 CS$(0) = "GRN YEL BLU RED": CS$(1) = "BUF CYN MAG ORA"
25 CLS: BL$ = STRING$(32,""): FC=4: CM=1: CS=0: BC=1
30 C$(1)=" GREEN
                   ":C$(2) =" YELLOW ":C$(3) =" BLUE
                                                            ":C$(4) =" RE
35 C$(5) =" BUFF
                     ":C$(6) = " CYAN
                                        ":C$(7) = " MAGENTA":C$(8) = " OR
40 GOTO 2000
45 PRINT@CP,CHR$(143);:C$=INKEY$:IF C$="" THEN PRINT@CP,CHR$(175
);:GOTO 45
50 RETURN
55 C=INSTR(1,"12345678",C$)
60 IF C=0 THEN RETURN
65 IF Cb=1 AND C<4 THEN C=C+4
70 IF Cb=0 AND C>4 THEN C=C-4
75 RETURN
105 C$=INKEY$: IF C$="" THEN 105
110 SCREEN 0,1
115 CP=CM*32:GOSUB 45
120 IF ASC(C$) = 94 THEN CM=CM-1
125 IF ASC(CS)=10 THEN CM=CM+1
                                                                Listing continues
130 IF CM<1 THEN CM=13
```



### Machine-Language Disk I/O & Other Mysteries, To Harness The Power of Disk Drives.

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1953 West 11th Street Upland,CA 91786 (714) 946-5805 When you are ready to save your masterpiece, simply select the save line and enter the file name you want to give the program. You are asked for a beginning line number for the Basic program. If the image is simply a drawing, 10 is a good place to start. If you plan to add some statements to the program to create a game, select a line number that puts the graphics in the correct location for your program.

#### **How It Works**

The program begins by initializing several needed variables and then, in lines 2000–2075, setting up the screen with the command list. It then jumps to the command-input routine at line 100. Lines 120 and 125 test input for the up and down-arrow keys (ASCII 94 and ASCII 10) and adjust CM to indicate the command selected. If you press enter, line 150 branches to an ON CM GOTO to dispatch to the section to handle the command.

Lines 200–295 handle the input of x and y coordinates. I tried to use joysticks for this, but found them somewhat clumsy and inaccurate. Note the use of INSTR in line 215 to select one of eight possible entries. This technique is faster and neater than the usual section of If...Then lines sometimes used.

The string D\$ is set up in line 15, using CHR\$ for each possible value of arrow and shift arrow keys. In 215 the entered variable, C\$, is tested with INSTR and, if any arrow was pressed, returns a value between one and eight. If any other character is pressed, C will be set to zero and the On GOTO will fall through to the next line.

The program data is stored in an array L\$, with LP pointing to the next element to add to the array. Note PIC-ED dimensions L\$ to 50. If you intend to create a very long program, you might need to change the DIM and the Clear for string space. The commands are added to L\$ without a line number. The tape-writing routine (lines 900–1015) adds a beginning line with PMODE 3,1 PCLS and Screen command and develops a line number based on the input value for starting line. A final line is added with a GOTO to maintain the display in the finished program.

I've found the program both fun to work with and useful as an easy way to generate graphics for other programs. It brings out the artist in everyone.

Ron Ginger (17 Potter Road, Framingham, MA 01701) owns a Color Computer and a PDP-11. His interests are computing and boat building.

```
Listing continued
135 IF CM>13 THEN CM=1
140 IF ASC(C$)=13 THEN 150
145 GOTO 115
150 ON CM GOTO 300,340,340,600,710,700,400,500,500,800,1100,1200
,900
200 REM *********COORDINATE INPUT**
205 PC=PPOINT(X,Y)
210 C$=INKEY$:IF C$="" THEN 210
215 C=INSTR(1,D$,C$)
220 PSET(X,Y,PC)
225 ON C GOTO 235,240,245,250,255,260,265,270
230 C=ASC(C$):RETURN
235 Y=Y-1:GOTO 275
240 X=X+1:GOTO 275
245 Y=Y+1:GOTO
250 X=X-1:GOTO 275
255 Y=Y-10:GOTO 275
260 X=X+10:GOTO 275
265 Y=Y+10:GOTO 275
270 X=X-10:GOTO 275
275 IF X>255 THEN X=255
280 IF X<0 THEN X=0
285 IF Y>191 THEN Y=191
290 IF Y<0 THEN Y=0
295 PC=PPOINT(X,Y):PSET(X,Y,(PC AND 7)+1):GOTO 210
305 CP=43:GOSUB 45
310 IF C$="1" THEN CS=1:GOTO 325
315 IF C$="0" THEN CS=0:GOTO 325
320 SOUND 10,5:GOTO 305
325 PRINT 043,CS;CS$(CS);
330 L$(LP)="SCREEN 1,"+C$:LP=LP+1
335 GOTO 110
340 REM B/F COLOR
345 CP=82:GOSUB 45:GOSUB 55
350 IF C=0 THEN SOUND 10,5:GOTO 345
355 PRINT@82,C;C$(C);:BC=C
360 CP=114:GOSUB 45:GOSUB 55
365 IF C=0 THEN SOUND 10,5:GOTO 360
370 PRINT @114,C;C$(C);:FC=C
375 COLOR FC,BC
380 L$(LP)="COLOR"+STR$(FC)+","+STR$(BC):LP=LP+1
385 GOTO 110
400 REM *********CIRCLES***********
405 CP=242:GOSUB 45:GOSUB 55
410 IF C=0 THEN 100
415 CC=C:PRINT@242,CC;C$(CC);
420 SCREEN 1,CS
425 GOSUB 200:IF C<>13 THEN 110
430 XO=X:YO=Y
435 GOSUB 200:IF C<>13 THEN 110
440 R=INT(SQR((XO-X)^2+(YO-Y)^2))
445 IF AR=1 THEN 525
450 CIRCLE(XO,YO),R,CC
455 L$(LP)="CIRCLE("+STR$(XO)+","+STR$(YO)+"),"+STR$(R)+","+STR$
 (CC)
 460 LP=LP+1
 465 IF AR=1 THEN 525
 470 GOTO 100
 500 REM *********ARC, ELLIPSES*****
 505 CP=271:GOSUB 540:ST$=N$:ST=N
 510 CP=281:GOSUB 540:SP$=N$:SP=N
 515 CP=304:GOSUB 540:HW$=N$:HW=N
 520 AR=1:GOTO 420
 525 L$(LP)="CIRCLE("+STR$(XO)+","+STR$(YO)+"),"+STR$(R)+","+STR$
       ,"+HW$+","+ST$+","+SP$
 530 CIRCLE(XO, YO), R, CC, HW, ST, SP
535 AR=0:LP=LP+1:GOTO 100
 540 REM *********NUMBER INPUT*****
545 PRINT @CP,"
                      ";:N$="
 550 GOSUB 45
555 IF ASC(C$)=13 THEN 575
560 IF ASC(C$)<46 OR ASC(C$)>57 THEN SOUND 10,5:GOTO 550
 565 N$=N$+C$: IF LEN(N$) =4 THEN 575
 570 PRINT @CP,C$;:CP=CP+1:GOTO 550
 575 N=VAL(N$):RETURN
600 REM ********LINES********
 605 SCREEN 1,CS
 610 GOSUB 200:IF C<>13 THEN 110
615 XO=X:YO=Y:PSET(X,Y,FC)
620 GOSUB 200:IF C<>13 THEN 110
 625 LINE(XO,YO)-(X,Y), PSET
630 GOSUB 660
 635 L$(LP) = L$(LP) + "PSET" : LP = LP+1
 640 GOSUB 200: IF C<>13 THEN 110
 645 LINE -(X,Y), PSET
```

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Pack port. Displays EBCDIC, ASCII, Binary
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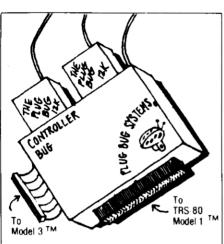
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```
650 GOSUB 665
655 L$(LP) = "L$(LP) + "PSET": LP=LP+1: GOTO 640
660 L$(LP) = "LINE("+STR$(XO)+","+STR$(YO)+")-("+STR$(X)+","+STR$(
Y) +") , ": RETURN
705 F=1
710 SCREEN 1,CS
715 GOSUB 200: IF C<>13 THEN 115
720 XO=X:YO=Y:PSET(X,Y,FC)
725 GOSUB 200:IF C<>13 THEN 115
730 IF F THEN LINE(XO,YO)-(X,Y), PSET, BF
735 IF F=0 THENLINE(XO,YO)-(X,Y),PSET,B
740 L$(LP) = "LINE("+STR$(XO)+","+STR$(YO)+")-("+STR$(X)+","+STR$(
Y) +"), PSET, B"
745 IF F THEN L$(LP) = L$(LP) + "F"
750 LP=LP+1
755 F=0:GOTO 100
800 REM *********PAINT****
805 CP=333:GOSUB 45:GOSUB 55
810 IF C=0 THEN 110
815 PP=C:PRINT @332,PP;C$(PP);
820 CP=350:GOSUB 45:GOSUB 55
825 IF C=0 THEN 110
830 BB=C:PRINT @350,BB;
835 SCREEN 1,CS
840 GOSUB 200: IF C<>13 THEN 110
845 PAINT(X,Y),PP,BB
850 L$(LP) = "PAINT("+STR$(XO)+","+STR$(YO)+"),"+STR$(PP)+","+STR$
(BB)
855 LP=LP+1
860 GOTO 100
905 CP=432:GOSUB 1240
910 CP=443
915 GOSUB 45
920 IF ASC(C$)=13 THEN 945
925 PRINT @CP,C$;:LN$=LN$+C$
930 IF LEN(LN$)=4 THEN LN=VAL(LN$):GOTO 945
935 CP=CP+1:GOTO 915
935 CF=CF1:GOTO 915
940 PRINT@450, "LOAD TAPE-PRESS RECORD";
945 C$=INKEY$:IF C$="" THEN 945
950 PRINT @500,"...WORKING";
955 OPEN "O",-1,N$
960 X$=STR$(LN)+" PMODE 3,1:PCLS:SCREEN 1,1":PRINT #-1,X$
965 LN=LN+10
970 FOR I=0 TO LP
975 X$=STR$(LN+I*10)+" "+L$(I)
980 PRINT #-1,X$
985 NEXT I
990 LN=LN+(I+1)*10
995 X$=STR$(LN)+" GOTO"+STR$(LN)
1000 PRINT #-1,X$
1005 CLOSE
1010 PRINT@448, BL$; : PRINT@478, BL$;
1015 GOTO 110
1100 REM *******LOOK AT GRAPHICS***
1105 SCREEN 1,CS
1110 GOTO 100
1200 REM **********************************
1205 CP=400:GOSUB 1240
1210 PRINT 0450, "LOAD A TAPE-PRESS PLAY";
1215 C$=INKEY$:IF C$="" THEN 1215
1220 PRINT 0500, "...WORKING";
1225 SKIPF N$
1230 PRINT @450,BL$;:PRINT @478,BL$;
1235 GOTO110
1240 REM *******FILENAME INPUT****
1245 NS=""
1250 GOSUB 45
1255 IF ASC(C$)=13 THEN RETURN
1260 PRINT @CP,C$;
1265 N$=N$+C$:IF LEN(N$) =8 THEN RETURN
1270 CP=CP+1:GOTO 1250
2000 REM *******SET UP TEXT SCREEN**
2005 CLS:PRINT08, "PICTURE EDITOR";
2010 PRINT03, "COLOR SET"; CS;CS$(CS);
2015 PRINT065, "BACKGROUND COLOR 1 GREEN";
2020 PRINT097, "FOREGROUND COLOR 4 RED";
2020 PRINT@97, "FOREGROUND CO
2025 PRINT@129, "LINES";
2030 PRINT@161, "OPEN BOX";
2035 PRINT@193, "FILLED BOX";
2040 PRINT@225, "CIRCLE C
2045 PRINT@257, "ARC START
2050 PRINT@289, "ELLIPSE H/
2055 PRINT@321, "PAINT COLOR
2060 PRINT@353. "LOOK AT DRAW
                                      COLOR";
                                     H/W";
                                                      BORDER";
2060 PRINT@353,"LOOK AT DRAWING";
2065 PRINT@385,"SKIP FILE NAME";
2070 PRINT@417,"SAVE FILE NAME
                                                         LN";
 2075 GOTO 110
```

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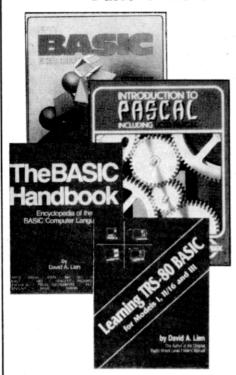
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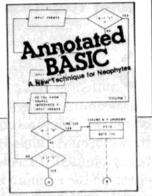
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## School micros: boon or bane?

### Panel to block conspicuous computing in schools

BY ERIC MALONEY 80 MICRO MANAGING EDITOR

Scam," "religion," and "fad" is how members of the Committee on Basic Skills Education describe the increased use of microcomputers in the classroom. The committee charges microcomputer manufacturers are making misleading claims to hustle their machines. It also says educators are throwing away money that could be used for better teaching tools and touting computers to cover up their failure to effectively teach basic skills.

"There is some sort of urgent requirement that every child must become computer-literate, which in the parlance of manufacturers means that he must learn how to interface with a computer and program a computer," said cofounder Eric Burtis. "This is absolutely untrue. The future of the U.S. is not based on everybody becoming computer-literate but on becoming literate in basic skills."

Congressman Stark: Public financing of Apple's merchandising plan for the 80s?

The committee was formed in April by Burtis and three other San Franciscoarea residents. Burtis is the president of Centurion Industries, a manufacturer of dedicated microprocessor-based learning machines.

Manufacturers are pushing schools to "get a computer first and then get the kid to learn the other stuff," Burtis said. He called it "tremendous overkill," and said schools often end up using their computers for drill and practice.

"Drill and practice can be done a lot more effectively and at lower cost in other ways," he said.

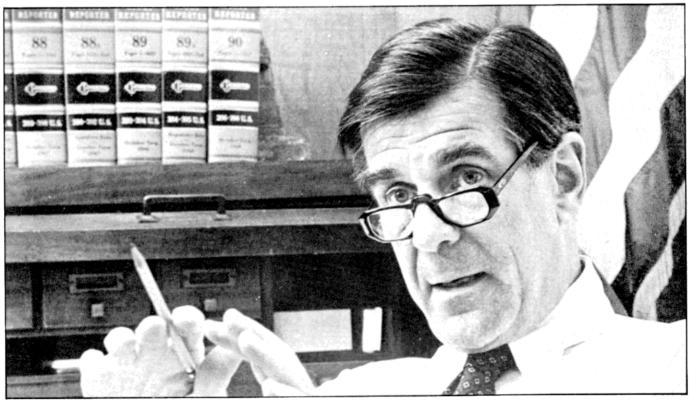
A. Daniel Peck, a professor of educa-

tion at San Francisco State University, agreed, saying a \$200 dedicated microcomputer is often far more efficient. He said schools are being pressured by manufacturers into buying micros, and then don't know what to do with them. He likens the micro boom to the large-scale purchase of language labs in the early 60s, which he said are now "languishing."

Burtis added: "American educators have a history of seeking a bandwagon as a means of disguising the real problems. Manufacturers say, 'If you want to do the job for the American public, you must use computers.' And the teachers say, 'If you can't teach kids how to read and write, maybe this will work.'"

But Burtis also placed part of the blame on parents: "Parents are distressed about their kids not being able to learn, so they say, 'Well, if these computers are the answer, then buy some.' The teachers are being told,

continued



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# **EDUCATION** continued

'You'd better get computers.' "

Burtis feels computer literacy is not the requirement for future success manufacturers and some educators claim it is.

"It's a lie to say to kids, 'If you become computer literate you'll be more successful in the world of tomorrow,' "he said, "because what they learn on a micro will have no bearing on what they will need in the future."

Burtis said manufacturers are imply-

ing computer literacy comes before traditional skills. But, he said, effective computer use "is dependent on the individual being academically proficient. If you don't have academic proficiency, the computer isn't worth a damn."

Burtis and Peck are opposed to the Technology Education Act, the so-called Apple bill encouraging manufacturers to donate microcomputers to elementary and secondary schools. The bill, introduced by Fortney H. Stark, Jr. (D.-Calif.), was prompted by an offer from Apple to donate 103,000 computer centers across the country.

"It's just another means of asking the public to fund a merchandising plan for a manufacturer," Burtis said. "I think it's disgraceful. Even Apple blandly admitted that the purpose of the bill is to get Apples in front of kids so they'll grow up with them."

Peck added that the Stark bill doesn't consider additional expenses the school will face to use the equipment, such as teaching aids, hardware, and software.

Is there a solution to the problems the committee sees? Burtis thinks the key is public awareness.

"People should demand of computer manufacturers, 'Hey, design them to make our lives easier,' rather than be told 'Here's a computer; figure out something to do with it,' "he said.

# Tandy says hard to find good numbers

When it comes to computers in education, good numbers are hard to find, said Radio Shack Education Director William D. Gattis.

Gattis, on CompuServe's TRS-80 owners' special interest group, defended Tandy's refusal to release information on its computer sales to schools.

"The fact is," he said, "we simply do not have exact figures representing total TRS-80 computers delivered to schools through our 4,300 companyowned Radio Shack stores in the USA, nor the 2,000 independent Radio Shack dealers. So while we do monitor school purchase orders processed through our National Bid Department in Fort Worth, this does not represent all our sales to schools."

"Our own experience," he continued, "leads me to question the claims by other manufacturers regarding their percentage share of the education marketplace. With their products being sold to schools primarily through independent dealers, they are even further removed from accurate and objective sources of information than we are."

Gattis said: "The figures released by commercial research firms are particularly frustrating since all have different numbers and almost none compare to our own current estimates. Of those I've seen recently, only the year-old Report on Microcomputers in Education published by Creative Strategies International seems to us a credible document."

"The only sources of statistics we've encountered that we feel we trust," he noted, "are the surveys conducted by the various state departments of education. These agencies have the attention of public school districts throughout a state in a way that no commercial firm has achieved. Whereas a commercial firm might do well to see a 5 percent to 6 percent response to a survey mailing, most of the state surveys report information from over 50 percent of the school districts in the state, and a couple are approaching 100 percent."

Gattis reported:

- In Pennsylvania, the contracting unit for microcomputer purchases for local agencies during 1981 reported \$1.52 million in purchases of five microcomputer brands—\$1 million of it for TRS-80s.
- In Florida, the state Education Department's Management Information Services Center reported late in 1981 that more Florida schools, 401, had TRS-80s in them than any other micro.
- In Louisiana, the state Education Department reported in February 1982 that more than 60 percent of the schools used TRS-80s.
- In Oklahoma, a survey conducted by the state Department of Education in December 1981 reported 70 percent of the micros in that state's schools were TRS-80s.
- In Kentucky, a survey conducted by KET-TV, the public education tv station operated by Kentucky State University, showed, with 78 percent of the districts reporting, that more schools used TRS-80s than the next two brands of computer combined.
- In Idaho, a survey reported 56 percent of the micros in that state's schools were TRS-80s.
- In Montana, 37 percent of microcomputers in the schools were Tandy's, compared with 27 percent for the second-place company.

"We are not saying that the results from these states can be extrapolated to the whole country," Gattis observed. "On the other hand, we did not simply choose to share information only on those states' surveys which appear favorable to us. So far, every state survey we've seen corroborates Radio Shack's position as a leader in the burgeoning educational use of microcomputers."

"Tomorrow, next week, or next month, we may get results from all other states that show us in a much weaker position," he added, "but I doubt it. Just as much as I would encourage anyone to doubt the so-called statistics from any source that's based on projection or assumption instead of good, objective accounting."



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# Health risks in V-games

Overreaction to games leads to heart disease

oncerned with the moral and intellectual effect of Pac-Man and its ilk on children, an army of parents across the nation is skirmishing with video game purveyors over regulation of arcade-style machines. The real danger, though, might not be to children, but to adults, who risk health problems by playing the games.

That's the indication of research conducted by Dr. Robert S. Eliot at the University of Nebraska Medical Center in Omaha.

Those indications became a deadly reality in Calumet, IL, where the stress from playing "Berserk" short-circuited an 18-year-old man's heart.

Eliot has tested more than 1,000 patients during the past five years to learn how they respond to stress. One conclusion he's reached is one-third of the nation's population are "hot reactors" to video games. Their bodies overreact to them, making them particularly susceptible to heart disease.

To identify hot reactors, Evans's lab has more than \$300,000 in computerized equipment: machines to monitor blood pressure, heart rate, stroke volume, adrenal gland secretions, and resistance the heart must overcome to move blood through the circulatory system. In an article appearing in the May-June issue of *American Health*, author Stephen Kiesling described a demonstration he witnessed at the lab:

"One of Eliot's patients, a middleaged administrator, has a base-line blood pressure of 134/89 when he sits down to play the game....

"But within seconds, though he doesn't feel any different, his body responds with signs similar to those of an athlete in action. His systolic pressure jumps to 207, while his diastolic pressure falls to 66. Meanwhile his pulse rate increases from 80 to 109 beats per minute, and his cardiac output doubles from 4.4 liters of blood per minute to 8.4 liters....

"So far the patient's body has reacted dramatically but in ways nature intended. Stress has triggered an outpouring of catecholamines, substances produced by the adrenal glands to stoke up the body to fight or flee.... To achieve the same elevated heart rate and blood pressure on a treadmill—or track— would take eight or nine



Photo by Omaha World-Herald

Eliot: Drag racing with the brakes on.

minutes rather than the same number of seconds....

"Activity uses up the catecholamines as they are excreted into the blood stream, damping the physiological increase. But instead of springing into action, the patient continues to play the video game. His physiological responses soon take an ominous turn....

"The patient still feels much the same, but his body is no longer behaving like an athlete's; instead, he has symptoms like those that can lead to a stroke. Stress is squeezing his blood vessels like a clamp on a garden hose.

"His peripheral resistance triples, cutting his heart output back to 4.4 liters per minute. His blood pressure goes from 207/66 to 183/125.

"Eliot stops the game. 'What you are doing,' he tells the patient, 'is like drag racing a car with the brakes on.'

Work with lab animals, Kiesling explained, has shown excess catecholamines can rupture small muscle fibers in the heart within five minutes. And autopsies of young men who suffered stress-related heart attacks showed their heart muscles had ruptured in seconds from stress-induced outpouring of catecholamines.

Kiesling wrote there are other stress producers in Eliot's lab—interviews, arithmetic tests, or holding a hand in ice water—that can create much the same physiological response. "The difference between those tests and video games," the author noted, "is that people don't go out of their way to engage in them, let alone spend countless hours and quarters for the experience."

According to Kiesling, Eliot said for hot reactors, video games "give all the excitement of competition without the physical component." He added Eliot fears "we may be heading toward a generation of hypertensives in this country where young people play video games instead of sporting activities which condition the body."

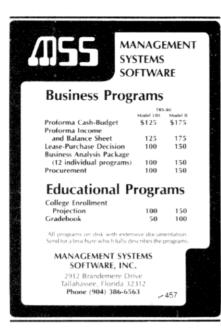
In the Calumet incident, the video game victim subjected an already weakened heart to the stress of playing "Berserk." Lake County, IN, Coroner Dr. Albert Willardo told 80 Micro Peter Bukowski had "some pathology in his heart muscle which probably was due to a viral infection that was not detected."

He explained: "All of us have had virus infections where we've felt pretty lousy for a long time and then we get well and we assume there's nothing left, there's been no damage, but in fact many times the heart and other organs have suffered damage.

Because Bukowski's heart was in a weakened condition, Willardo said, "anything could have precipitated the cardiac arrhythmia which ultimately caused his death. It could have happened while he was playing tennis or just walking down the street."

Despite his findings, Eliot has no ill-feelings toward video games. He told the *Omaha World-Herald*: "Video games can be a form of relaxation for many people; a means of taking your mind off your troubles. But we use video games as a diagnostic tool because they offer one way of testing how an individual deals with pressure."

If a person is a hot reactor, he added, he or she should "seek appropriate help and advice that will allow them to handle game and real-life pressures. It doesn't mean they have to give up playing. If you react poorly to adding up a column of figures, you don't stop doing your income tax."







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# ™TRS80 color

From the January 1981 issue of the CSRA Computer

There was some amusement at the Novem There was some amusement at the Novem-ber meeting when the Radio Shack repre-sentatives stated that the software in the ROM cartridges could not be copied. This month's 68 Micro Journal reported they had disassembled the programs on ROM by covering some of the connector pins with tape. They promise details next month. Never tell a hobbyist something can't be done! This magazine seems to be the only source so far of technical informations on the TRS-80 color computer ... Devoted to SS-50 6800 and 6809 machines up to now, 68 Micro Journal plans to include the TRS-80 6809 unit in uture issues.

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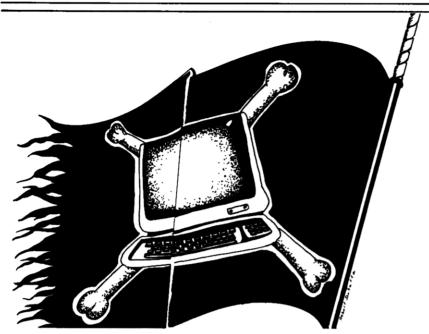
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# Wordstar makers win lawsuit against pirates

MicroPro International and Digital Research settle out of court with Sunnyvale softbucs

> By KERRY LEICHTMAN 80 Micro Staff

Claiming the first major victory in the war against software thieves, the makers of Wordstar and the CP/M operating system won a \$250,000 judgement against Data Equipment Inc. of Sunnyvale, CA, and its chairman, Daniel O'Rourke.

MicroPro International and Digital Research Inc. filed their lawsuit in November 1981, (see 80 Micro, March 1982, page 378). In September, San Francisco Federal District Judge William W. Schwarzer entered a stipulated final judgement against Data Equipment.

The suit claimed Data Equipment produced and distributed unauthorized copies of MicroPro's Wordstar, Datastar, Wordmaster, and Mail Merge programs, and Digital's CP/M operating system. Data Equipment acted as an OEM distributing complete hardware and software systems to businesses. MicroPro and Digital Research discovered the misuse of their programs when Data Equipment customers called them for update information.

According to the terms of the settlement, Data Equipment will pay \$250,000 to the plaintiffs, and will reimburse their legal expenses. In addition, Chair-

man O'Rourke is personally obligated to pay the plaintiffs \$30,000.

While it is disputable whether this was the "first ever microcomputer software copyright infringement suit" settled in favor of a program's originators, experts said this and several other similar cases are fine tuning the 1976 Copyright Act into good protection for microcomputer product originators.

Seymour Rubinstein, president of MicroPro, also hopes the rest of the industry will be encouraged by the court's favorable decision, "Our success... should be taken as a sign that software manufacturers will act aggessively to protect their own products against all unauthorized duplication."

Daniel T. Brooks, of Computer Law Advisors, Washington, DC, thinks the present copyright laws are plenty thorough. Quoting from the bill that eventually became copyright law, Brooks told 80 Micro during a telephone interview, "Under the bill, it makes no difference what the form, manner or medium of fixation may be; whether it is in words, numbers, notes, or any other graphic or symbolic indenture; whether embodied in a physical object, in written, printed, punched, magnetic, or any other stable form, and whether it is capable of perception directly or by means of any machine or device known or later developed."

To Brooks the law is very clear in definition and intent. The other school of thought likens Read-Only Memory to a permanent machine part. Its code, its proponents contend, speaks directly to the machine, not to human beings, and therefore is not copyright protected.

There is legal precedent in that argument. The U.S. Supreme Court ruled (White v. Smith) at the beginning of this century that piano rolls for player pianos were not subject to copyrights, because their code was not designed to be communicated to human beings. Brooks explained, "At that point in time the Supreme Court was saying the copyright laws applied only to those things which the copyright laws say they apply to and we don't see where this applies, therefore no protection."

"In 1976," Brooks continued, "Congress expressly overruled that result. There's a whole paragraph in the legislative history that basically says this particular section is designed to overrule that notion. It says, 'This broad language is intended to avoid the artificial and largely unjustifiable distinction derived from such cases such as White-Smith, under which statutory copyright ability has been made to depend on the form or medium in which the form is fixed.'

"Whether it be the MicroPro case or Tandy v. PMC, the decisions are coming out in the right places now. The program, in ones and zeros, or in the volts and amps form is simply a representation of a copyrighted work and with the aid of a machine or device, may be communicated to human beings."

When a judge sits before two people where one is suing the other for a copyright infringement on a computer program he has to fully understand the issues before him so that he can make the right decision. Judges, like a lot of society, are not educated in the bits and

continued

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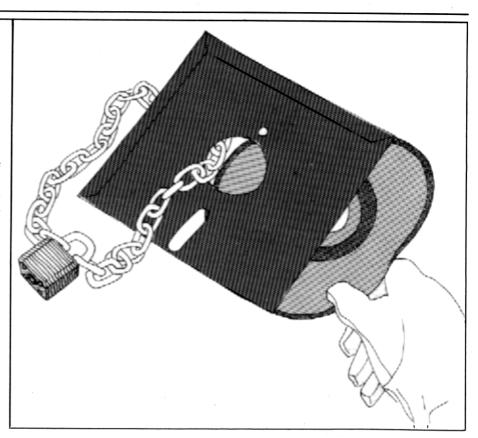


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# **LAWSUIT**continued

bytes of computerdom. Brooks said the confusion, which led to some rulings inconsistent with the intent of the law, is understandable: "They do not have a working familiarity with what computers are about. Many of them look at it as an alien object. The consequence is that there is some room for confusion until responsible lawyers have framed the arguments in intelligible form providing the information the judiciary needs to make the right decision."

Will the framing take much time? Brooks doesn't think so: "I hope within a few years this particular point will go away. That isn't to say that the fertile mind of man won't come up with some new ones. It's only that this particular one will have disappeared.



# **Networking Poet Laureate**

# E-poet says micros will shatter Gutenberg literature

By JOHN P. MELLO JR.

80 MICRO NEWS EDITOR

hen the wired generation holds its convention to nominate candidates for Poet Laureate of the Network Nation, expect to see the name of David Hughes on the ballot.

Hughes, 55, believes some day microcomputers will shatter traditional forms of writing based on Gutenberg technology. He's paving the way for the new literature by championing the cause of vanity publishing on The Source, a computer-based information service owned by Readers Digest.

"I said to Readers Digest," the former West Point teacher told 80 Micro, "I don't think you know what business you're in. You think you're selling information. I think you're selling electronic experiences."

He pointed out to Source officials: "Isn't it interesting that use of chat and mail—lateral contact between users—is far greater than the use of some of the dead data bases?"

Chat and mail were okay, but I

Hughes maintained subscribers needed more sophisticated lateral contact. How The Source met that need, the community planner and educator said, is "almost a revolution in electronic literature.'

"What we did was create magazines on The Source," Hughes explained. Authors of the magazines receive royalties based on how often their work is accessed by subscribers. Over a three month period, Hughes' magazine earned him \$826 in royalties.

But there are costs to vanity magazine publishers, Hughes noted. They pay for time—time needed to load their material into the system and time to store it there. Storage fees are on a sliding scale based on blocks of 2048 characters. about 380 words. For the first 10 blocks, a vanity publisher is charged 50 cents a block a month; for blocks 11 to 99, 20 cents a block; 100 to 999, 15 cents; 1,000 to 9,999, 10 cents.

"The magazine can definitely pay for itself if you put together an electronic bestseller," the Joy, CO, native said.

He added: "Imagine the kid that sits down, writes a piece, and can publish it nationally. He can begin to get his reputation. If he's got something to say, people will access him. If he doesn't, he's paying for it. It's self-correcting because he's not going to store forever garbage nobody reads."

Hughes' magazine, SourceTrek, includes 13 pieces ranging from a speech delivered to the Colorado Springs Rotary Club to ghost stories of Colorado. He uses his e-mag to experiment in writing beyond the Gutenberg dimension.

"A lot of word processing assumes the name of the game is to sit and use the screen to reproduce Gutenberg en

continued

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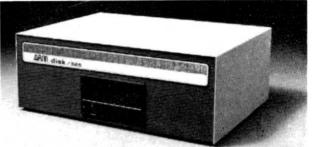
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# **HUGHES**continued

route to a piece of paper," he contended, "but I think you can do things on a screen you can't do on a piece of paper."

Hughes maintained that until now, writing has operated on a fixed data base—the 26 letters of the English language-and required our eyes to be dynamic. He reasoned, "If you take the dynamic things of games-the graphics—and apply them to letters, I've got a sneaky suspicion we will create a new form of extension."

Hughes playfully emphasizes this point in the opening of his magazine. He prints on the screen a quote from The Rubaiyat of Omar Khayyam:

The Moving Finger writes; and, having writ, Moves on: nor all your Piety nor Wit Shall lure it back to cancel half a Line,

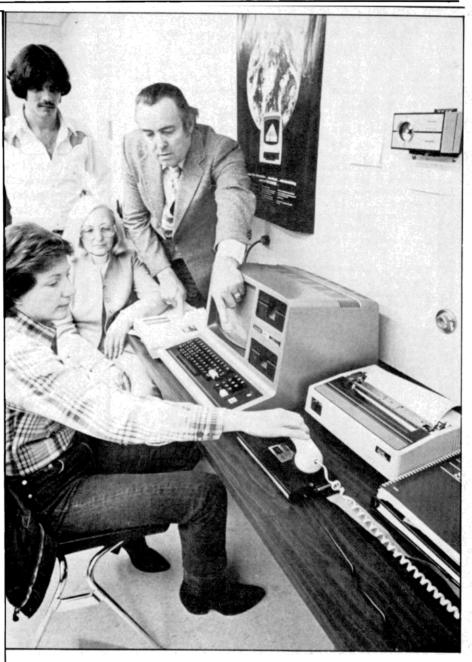
Then he reverses the cursor and erases half a line.

On another occasion, Hughes was inspired by an Orchestra 80 rendition of a Scarlatti pastoral he downloaded from CompuServe. He wrote for his magazine an article titled "Sunday on a CRT." "When I reached the point in text," he said, "where in the print world you would describe the music, suddenly I realized, 'Why should I do this?' I went back to the file, picked a fragment of code, embedded it in the text and went on."

During the last two years, Hughes has pushed beyond the limits of the alphabet in what he calls "word. dance." He described the technique as "creative electronic literature beyond the edges of Gutenberg English."

"One of my first tasks," he explained, "was to eliminate punctuation on the screen, on the ground there's a brain equivalent and ways to make emphasis occur on the screen that are superior."

"This convention called punctuation," he continued, "is nothing more than ASCII English-in other words, code. When I speak, I don't say comma or period, but on paper, I have to have a comma to pause. On the screen, I don't I tion that until the people with words be-



Hughes and some of his students practice their Electronic English with the help of a micro.

have to have a comma. I can actually pause."

Hughes isn't the only artful experimenter on The Source. People have composed electronic duets in verse. They have assumed fantasy roles, like the Pink Elephant, and conducted improvisational "theater" on the message system. "That's damn exciting," the electronic bard said, "because I think it will draw people into the computing world who call computers dehumanizing. I say they are the most humane thing ever invented."

He added, "It is my absolute convic-

gin to understand computing in a cultural context, not as a clerical skill, not as a computer skill; that they see telecommunications as a device that can do things other technologies cannot do; then we're not going to drag enough of the human race into this."

One way to get people to understand the cultural ramifications of computers is through education. But much of that has become part of the problem, according to Hughes. He declared: "This myth that everyone has got to learn to program is one of the biggest impedi-

continued

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# **HUGHES**continued

ments to why people aren't getting into computers."

"Computer literacy has come to mean programming classes," he continued. "Even when Radio Shack offers teachers programming classes, they find very few English teachers. And after the few English teachers that show up learn to program, they ask, "Now what?""

"A woman can learn how to drive a car without learning how to build an internal combustion engine," he observed. "I say to my students, 'I will teach you how to write on this thing. Then it might become useful for you to learn how to program.' Just like a woman might learn how a carburetor works so she won't get ripped off by a mechanic."

Hughes has pioneered a college credit course for Colorado Technical College called Electronic English. The entire course is conducted over The Source.

He said his course focuses on screen characteristics and teleconferencing.

"People 'recite' in class," he noted.

"I grade them on screen readability. You're taught in speech class about how to stand when you talk, eye contact, and having your voice loud enough to be heard. In electronic speech, if you want to be an effective writer, you have to be acutely conscious of what a person is reading, how they're reading it, and the rate they're reading it.

"If you can't handle a keyboard, don't know what a smart terminal program is, don't know what 300 baud and ASCII code is, don't visualize what a guy with an Apple with 40 characters uppercase only is seeing while you're writing in 64 characters upper- and lowercase, you don't know how to speak to another person."

Guest teachers in Hughes' classes don't give lectures. They give electures, plugging their lessons into The Source where students access them.

Hughes explained his students put in three hours of class work a week but don't meet at regular hours. However, his course differs from correspondence courses because a student is connected to his classmates and the instructor.

Two or three times during the 11-week course, he continued, students must "bring their brains to the classroom." During those sessions,

students upload 2,000 word compositions and the class discusses them on the system in real time.

Hughes also teaches his classes about software aids to writing like Aspen Software's Grammatik, Proof-Edit, and Proofreader. And he leads discussions on what freedom of information means in the electronic era.

"Why don't we create programs that allow the individual to screen, by a filter, words offensive to him," he opined. "System operators should never try to censor what a speaker says because in the microcomputer age, readers can be their own censors based on their own value system."

Hughes' students attend his classes from all over the United States and the world. They've included a former lieutenant governor of Alaska, a hay and grain dealer in Iowa, a travel agent in Australia, and a professional writer in London.

The electronic educator believes breaking down geographical barriers through microcomputer networks can preserve cultural diversity.

He cited the case of Anne Charles, a 21-year-old Cree Indian, who travelled 350 miles from L'Orange to Regina, Canada, to ask Hughes if she could take his course. Hughes, who was in Regina to address the International Association of Business Communicators, told the association's conferees:

"Anne Charles wants to be a journalist. She does not have to move to Montreal and become French-Canadian to do that. She could learn journalism while staying in L'Orange, then turn around and export the culture of her people for pay."

Later, Hughes explained to Charles how she could use an Epson printer to preserve the Cree language: "For her uncles, who speak Cree and write in a cunieform, I did a quick little program that spit out of the Epson the language of her people in cunieform form. I said her brothers and sisters could learn how to put the speech of her people on an Epson and communicate it over network lines."

By using microcomputer technology in this fashion, Hughes contends society "can really start to solve the cultural and economic problems of the world."

"We already provide highways for people's bodies to get them to big centers," he observed. "Why don't we provide highways for their minds?"

"We already provide highways for people's bodies. Why don't we provide highways for their minds?"



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# PULSETRAINLTLTLT

# Will the meek inherit the market?



Industry watchers were surprised by the meek pricing moves made

by Atari and Commodore in the face of Texas Instruments' \$100 rebate plan, according to Electronic News.

That weekly speculated soon after TI announced its rebate plan Atari was prepared to give away \$150 in software and gift certificates to buyers of its lowend micro and Commodore would be knocking \$50 off its VIC.

The official word from the two firms, however, was less dramatic. Atari—faced with potential resistance from retailers for whom software is a high margin item—anounced it would offer six \$10 certificates good for software and peripherals with the sale of its 400 computer. And Commodore revealed a \$25 to \$40 VIC pricecut, depending on purchase volume.

Electronic News also reported the low-end-micro price war has forced Commodore to change some of its production and marketing schedules. Production of the VIC, set for 50,000 units a month, has been upped to 70,000 units a month. That, in turn, has reduced Commodore's commitment to its new game micro, the MAX Machine.

Commodore had planned to place equal marketing



Roach: We've been tarred and feathered.

emphasis on the VIC and MAX Machine, but the firm's vice president for marketing, Kit Spencer, told the newspaper: "We have decided to make VIC our major product for the Christmas season."



Electronic News said Tandy's official line on the fireworks in the low-end market is its companyowned stores insulate it from price bombings. Tandy's president and chief executive officer, John Roach, told the industry weekly: "We're getting tarred and feathered with people guessing our response to the TI, Commodore and Atari business. It's difficult to understand. We're a retailer and whatever our strategy is, we will not talk about it until we implement it."

# Computer division boosts Tandy's profits picture



Tandy Corporation experienced a 32 percent jump in profits for its

fiscal year ending June 30. Contributing to the increase was a 72 percent hike in shipments from its computer division.

The \$224 million in profits for the 1982 fiscal year compares to \$169 million earned in FY1981.

The Fort Worth firm estimated computer revenues account for 31 percent of its annual revenues.

Computers are in a strong growth cycle, the company noted, and calendar 1982 will be the first big year for home sales.

Tandy projects sales of its product will grow three

to four times in 1982, compared to 1981.

The firm also said early orders for its Model 16 have exceeded expectations.

# Tandy to give National Science Foundation hardware



Tandy Corporation announced an agreement with the National Sci-

ence Foundation to provide computer equipment to institutions for use in education programs in science, mathematics, and engineering through the Fort Worth firm's TRS-80 Educational Grants Program.

The foundation, an independent agency of the U.S. government, will be awarding the computers as the equipment portion of projects supported by its ongoing development-inscience education program.

Charles Phillips, Radio Shack senior vice president for special markets, told the T.H.E. Journal the program is "a timely and important step supporting the need for renewed emphasis on science education in this country."



He added that "this participation with NSF is in accord with the philosophy behind our Tandy TRS-80 Educational Grants Program—that is, rather than simply giving out hardware, we want to support projects that have a meaningful plan for educational applications using that hardware."

# PROGRAMMING TOOLS FOR YOUR TRS-80<sup>TM</sup> MODEL I AND MODEL III

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The INSTANT ASSEMBLER is a powerful disk or tape-based assembler and debugger for the TRS-80. Now you can assemble directly to memory and immediately debug your program with the built in single stepping debugger. Quickly switch from assemb debugger and back again without losing the source code. This feature makes INSTANT ASSEMBLER an excellent learning tool for assembly language programming.

INSTANT ASSEMBLER is absolutely unique among tape based assemblers in that it produces relocatable code modules that can be linked with the separate LINKING LOADER, which is supplied in two versions for loading programs into either high or low RAM. This lets you build long programs with small modules. INSTANT ASSEMBLER also features immediate detection of errors as the source code is entered, a compactly coded source format that uses 1/3 as much memory as standard source, and many operational features including single stroke entry of DEFB and DEFW, pinpoint control of listings, alphabetic listing of symbol table, separate commands for listing error lines or the symbol table, block move function, and verification of source tapes.

INSTANT ASSEMBLER's debugger provides single stepping with full register displays, decimal or hex entry of addresses, forward or backward memory displays, disassembly of ory, memory display in ASCII format, and hex-to-decimal or decimal to-hex conversion. The single-stepper will step one instruction at a time or at a fast rate to any

INSTANT ASSEMBLER occupies less than 8400 bytes of memory. In a 16K m will leave you enough memory to write assembly language programs of around 2000 bytes. This and its module-linking feature make INSTANT ASSEMBLER ideal for users with only 16K machines. The instruction manual may be purchased separately for \$3, which will apply towards the purchase of the INSTANT ASSEMBLER. In addition to disk I/O, the disk vers includes a stand-alone version of the debugger.

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This program is a full feature print formatting package featuring user defineable line and page length (with line feeds inserted between words or after punctuation), screen dump, printer use control, and baud rate selection. In addition, printing is done from a 4K expandable buffer area so that the LPRINT or LLIST command returns control to the user while printing is being done. Works with cassette or disk systems. Ideal for Selectric or other slow printers. s printing and processing to run concurrently. Output may be directed to either the parallel port, serial port, or the video screen. 80 Microcomputing said "I can only give my highest recommendation of Spooler and Mumford Micro Systems Specify Model I or Model III. SPOOLER ...... \$16.95 on tape, \$21.95 on disk

# **DUPLICATE SYSTEM TAPES WITH CLONE**

Make duplicate copies of almost any tape including Basic, SYSTEM, data lists, assembler ource, or "custom loaders". The file name, load address, entry point, and every byte (in ASCII format) are displayed on the video screen. Model III version allows changing tape ed so you can load in a tape at 500 baud and write it out at 1500.

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# MACHINE CODE FAST FOURIER TRANSFORM

Written by Dr. A.H. Gray, Jr., co-author (with J.D. Markel) of the classic text "Linear Prediction of Speech\*, this complete package includes 3 versions of the machine language FFTASM routine assembled for 16, 32, and 48K machines, a short sample Basic program to access them, a 10K Basic program which includes sophisticated interactive graphing and data manipulation, and a manual of instructions and examples. The machine language subroutines use variables defined by a supporting Basic program to make data entry and retrieval automatic, without PEEKs and POKEs. They perform 20 to 40 times faster than their Basic equivalent (256 points in 12.5 seconds), and handle up to a 1024 point complex FFT. The 

INSIDE LEVEL II
The Programmers Guide to the TRS-80 ROMS

INSIDE LEVEL II is a comprehensive reference guide to the Model I and Model III ROMs which allows the machine language or Basic programmer to easily utilize the sophisticated routines they contain. Concisely explains set-ups, calling sequences, and variable passage for number conversion, arithmetic operations, and mathematical functions, as well as keyboard, tape, and video routines. Part II presents an entirely new composite program structure which loads under the SYSTEM command and executes in both Basic and machine code with the speed and efficiency of a compiler. In addition, the 18 chapters include a large body of other information useful to the programmer including tape formats, RAM useage, relocation of Basic programs, USR call expansion, creating SYSTEM tapes of your own programs, interfacing of Basic variables directly with machine code, and special precautions for disk systems. INSIDE LEVEL II was reviewed in the April 1982 issue of 80 Microcomputing which said "The book has no flaws, it is a perfect gem." Byte Magazine said "I recommend this book to serious machine language programmers."

### SINGLE STEP THROUGH RAM OR ROM

STEP80 allows you to step through any Basic or machine language program one instruction at a time, and see the address, hexadecimal value, Zilog mnemonic, register contents, and step count for each instruction. The top 14 lines of the video screen are left unaltered so that the "target program" may perform its display functions unobstructed. STEP80 will follow program flow right into the ROMs, and is an invaluable aid in learning how the ROM routines function. Commands include step (trace), disassemble, run in step mode at variable step rate, display or alter memory or CPU registers, jump to memory location, execute a CALL, set breakpoints in RAM or ROM, write SYSTEM tapes, and relocate to any page in RAM. The display may also be routed to your line printer through the device control block so custom print drivers are automatically supported

### **SMART TERMINAL PROGRAM**

This machine language program may be used as a smart terminal with time share systems or for high speed file transfers between two disk-based micros over moderns or direct wire. It is menu driven and extremely simple to use. Functions include real-time terminal mode, save RAM buffer on disk, transmit disk file, receive binary files, examine and modify UART parameters, program 8 custom log-on messages, automatic 16-bit checksum verification of accurate transmission and reception, and many more user conveniences. Supports line printers and lowercase characters. With this program you will no longer need to convert machine language programs to ASCII for transmission, and you will know immediately if the

# **DISK INDEX VERSION 3.0**

Our excellent disk indexing program has now been entirely rewritten in machine language. It will run on either a Model I or Model III and catalog disks for either machine regardless of which one is running it. (Model I owners must have double density to catalog Model III disks.) DISK INDEX will assemble an index of your entire program library by automatically reading program names and free space from each disk directory. The index may then be alpha or searched for any disk, program, or extension. Disks or programs may be added or deleted, and the whole index or any part may be sent to the printer. The index itself may also be stored on disk for future access and update. A 48K machine will hold over 2500 programs in each index, and you may build as many indexes as you need. Version 3.0 runs substantially faster than our previous version and works with any operating system written for the Model I or Model III except CP/M.

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# **PULSETRAINLTLTLT**

# Cosmo discovers **Network Nation**



The Cosmo girl has discovered the Network Nation and it looks like an

8.5. "Forget dating through the personals or friends' fixups!" Cosmopolitan magazine exhorted its readers in its September issue. "An electronic brain right in your own living room can introduce you to thousands of men...in seconds!"

Cosmo discovered the wonders of networking through author Elizabeth Ferrarini, who stumbled on The Source while looking for a man "who'll be G.I.B., pay for dinner, and treat me like precious porcelain...have a college degree, solid profession, good looks, weight in proportion to height, and make at least \$50,000 a year."



Despite her assetsmagna cum laude college graduate, homeowner, latemodel sports car driver, and good teeth—Ferrarini found "Mr. Terrific was being strangely elusive."

"Just in time to avert terminal loneliness," she wrote, "a friend told me about a company that allows nearly 20,000 computer owners to communicate with each other in a flash. When I learned that over 90 percent of these computer buffs are males. their median age is 35, and they are college-educated

professionals with an average yearly income of almost \$50,000, I knew the object of my capitalistic fantasies must be among them."

After purchasing a micro and learning how to use The Source, the Cosmo author realized the potential of networking: "Using my computer to communicate via the telephone line, I could dash off torrid love letters, place ads on an electronic bulletin board, and even carry on 'conversations' with other subscribers by way of our respective computers' keyboards. Admittedly, all of this sounded to me like science fiction. Imagine getting my mail delivered by an electronic brain and communicating with people I'd never seen. A smart chimpanzee could be sending me electronic billets-doux."

Ferrarini placed a lonely hearts message on The Source's electronic bulletin board and 24 hours later. she had 16 e-letters, 12 of them with one thing in common: a trip to her home state within the next two months.



Overall, the Cosmo author appeared satisfied with the chipsters her ad attracted. "Although I've encountered my share of duds," she wrote, "computer owners are, on the whole, a likeable lot. With my desk-top model and a telephone, I can plug into an endless supply of available males-and keep my checkbook balanced, too."



# **Computer life** after 40?



Is there computing after 40? The Source says communications yes. In a statement on

a recent survey it completed on its subscribers, the information utility said the average age of its users is 42, three years older than the average age in 1981. The Source also noted 64 percent of its subscribers are over 35, compared to 56 percent last year.

In a related matter, The Source announced it is carrving an electronic version of the U.S. News Washington Newsletter. According to a statement from the information utility, each week the letter carries about a dozen stories on investment opportunities, economic trends, and key government activities.

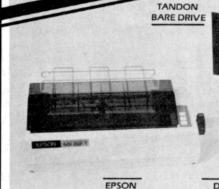
# Apple millionaire raps Woodstock



Although pre-concert publicity touted the US Festival as the Wood-

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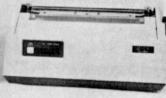
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# **PULSETRAINLTLTLT**

who picked up the \$13 million tab for the event disavowed any similarities between the rock-a-thons.

Millionaire and Apple computer founder Steve Wozniak rapped Woodstock in an article appearing in the Providence Sunday Journal, "If I listed the things that were wrong with Woodstock, it would overflow one diskette on my word processor," he said. "Woodstock was really a lot of lies, miserable lies. They were a bunch of hippies spending money that wasn't even theirs. They didn't even have any sanitation."

Sanitation is something they had plenty of at Wozniak's concert. At the 500-acre park carved to Wozniak's specifications by the construction superintendent at Disney World, there were 2,500 latrines, the best commode-toconcert-goer ratio in history.

Apparently, US Festival planners hoped its participants would react differently to their concert than their Woodstock predecessors. While people attending Woodstock professed to be members of a mythical love-peace entity called "The Woodstock Nation." rock impresario Bill Graham told the Journal that an US Festival goer—gazing at laser lights and multi-dimensional visual effects—was supposed to "feel like an extra in a Steven Spielberg movie."

"Woodstock was essentially anti-establishment," one festival goer, a 30-year-old insurance man from Santa Barbara, CA, opined. "This festival isn't

anti-establishment. Hell, we are the establishment."

# Computer books hot, but some make them shoddy



Computer books have been selling as never before and publishers

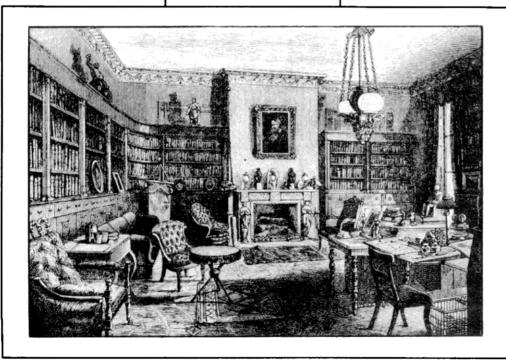
are turning out dozens of new titles every month. Unfortunately, according to *Omni* magazine, in the scramble to publish as many computer books as possible, publishers have rushed out amateurish guides written by computer freaks who know their subject but don't know how to explain it clearly.

The opportunistic tactics that some publishers employ can also contribute to low standards in computer books, Charles Platt wrote in the pop-science magazine.

He added: "Anyone who writes a short article for one of the computer magazines. for instance, will have his name picked up by at least a couple of book publishers, who'll send form letters encouraging him to write a book for them on any computer-related subject, regardless of his qualifications. Indeed, some book publishers prefer to hire amateurs, because they are less trouble to work with. A would-be writer, excited by the prospect of seeing his work in print, won't complain if the publisher makes changes, and he will do the work for lower pay."

But even books done by reputable publishers and professional authors can be disappointing, Platt said. He cited the second edition of *Personal Computing*, by Daniel R. McGlynn, published by John Wiley and Sons of New York. Although authoritative and thorough, Platt noted, readers without a science background will find the book's explanations difficult to understand.

Another book that looks like a winner but is disappointing, he said, is Without Me You're Nothing, by Frank Herbert, author of Dune. "Herbert claims he's out to debunk and demystify computers," Platt wrote, "but he has a technofreak's love of jargon and the book is full of sweeping generalizations that betray a lack of firsthand experience. It will intimidate



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# **PULSETRAINLTLTLT**

and baffle the reader who does not already own a computer and doesn't know the language."

Platt identified as a useful and well-researched handbook Wilma E. Bennett's Checklist/Guide to Selecting a Small Computer, published by Pilot Books of New York. The book contains no fewer than 332 questions to ask a computer salesman before you buy a computer.

And if you need excuses to avoid buying a computer, there's Computer Choices: Beware of Conspicuous Computing!, by H. Dominic Covvey and Neil Harding McAlister. Platt said that book debunks the whole computer fad with case histories of small businesses that went bankrupt after computerizing and private users who bought home computers, couldn't find anything useful to do with them, and abandoned them to gather dust in the attic.

# Teacher shortage giving high-tech advantage to Japan, Germany



A worsening math teacher shortage is allowing Germany and Japan to

develop the capability to outdistance the United States in the high-technology era, according to Dr. Stephen Willoughby, president of the National Council of Teachers of Mathematics.



Studies by the NCTM have yielded results similar to findings by independent researchers (see 80 Micro, October 1982, p. 382). They show the math teacher shortage the most severe of any subject taught in the nation's education system. The shortage of science teachers is next.

Since 1972 there has been a 77 percent decline in the number of secondary-level mathematics teachers prepared in 600 teacher-training programs nationwide. And only 55 percent of graduates prepared to teach math go into teaching.

Willoughby, in a report by United Press International, estimated more than half the new math teachers are not qualified to teach.

The situation can be turned around, however, by some proposals currently before Congress, he said. Those bills would—

- Set up tax credits for firms assigning full-time math-competent workers part-time to teach in public schools;
- Give tax credits to firms hiring math and science teachers for the summer; and
- Direct loans at 7 percent interest to students aiming to teach math or science.

# Japanese penetrate disk-drive market



Increased Japanese penetration into the U.S. disk-drive market was

reported by the *Electronic News*.

Alps Electronics Ltd. of Tokyo dislodged Shugart Associates as a supplier of 5.25-inch drives to Apple, the industry weekly reported, while TEAC won a 5.25-inch drive contract with the Digital Equipment Corporation and Sony locked up a \$30 million contract to supply 3.5-inch



drives to Hewlett-Packard.

It was a low bid that won the Apple contract for Alps. The Tokyo firm bid under \$50 a drive to supply the mechanism-only devices to Apple, which will insert the controller-boards in the drives.

Despite Alps' and TEAC's victories in the 5.25-inch market, the Japanese may be planning to corner the disk-drive market elsewhere. Grover Mullin, general manager of OEM market requirements for Control Data Corporation of Minneapolis, told *EN*.

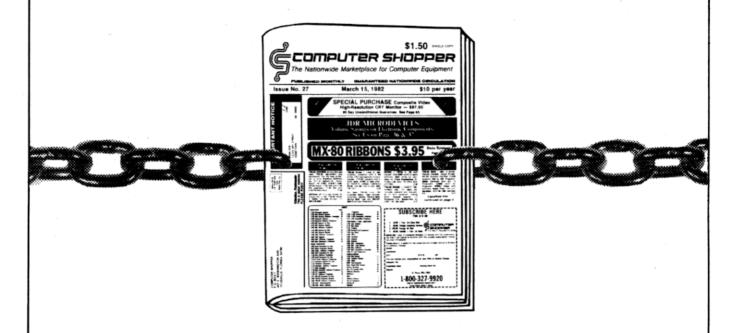
Since the Japanese entered the 5.25-inch market late, he contended, they might concentrate on putting higher density on smaller floppies.

Sony is the only company to deliver to the U.S. market a microfloppy drive—3.5 inches, single-sided, double-density—although Hitachi and Matsushita are ready to bring their 3-inch drives to market. Sony is expected to release a double-sided microdrive next year.

In addition to increased activity in the microfloppy market, 5.25-inch and 8-inch manufacturers are finding a demand for slimline or half-height drives. Some 1500 8-inch half-height drives a month are being shipped by NEC, EN reported.

Currently, NEC and Tandon are the only firms producing the 8-inch half-heights, but MPI, Shugart, Qume, and Mitsubishi have announced they will be producing them, lowering the price of the drives to \$370 a

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# **PULSETRAINLTLTLT**

drive for volume shipments.

One NEC official told EN: "We're seeing a lot of interest in the product. The fact that it has reduced power requirements and can fit in a smaller space makes it attractive to customers.'

# Anti-video game forces paranoid



Computer games aren't creating a generation of computer zombies, a

child psychologist and computer expert said in a report appearing in the Providence Journal.

Mitchell Robin, a professor of psychology at the New York City Technical College, maintained parents are "paranoid" about computers, because they grew up during a period when the machines were portrayed as Ghengis Khans in waiting just biding their time until

# Correction

In the October issue of 80 Micro the number for Bob Rosen's BBS was published incorrectly. The correct number is (212) 441-3755.

the malevolent machines could take over the world and force humans to watch reruns of I Love Lucy.

In the story appearing in the Rhode Island daily. Robin said his two daughters, aged 8 and 5, are more proficient in killing off multi-colored video monsters than their father, something he doesn't mind.

"When they win," he said, "I'm delighted they can see dad as being fallable. They learn that I'm human with limitations and that I'm not always successful in what I'm doing. I'm not superhuman."

Robin contended parents could learn a great deal about themselves and how their children see them competing with them in video game play:

"I find that parents who must always be right and never lose anything are parents whose children distrust them. Parents are humans and we tend to get very easily seduced into being perfect" in the eyes of children.

Robin debunked a common fear among anti-video game elements that the machines' warlike, violent themes will have a bad effect on children: "I've worked in programs with children as young as 8 years old. I see their humanity increasing, not decreasing."

# Commodore's Fink moves to ad agency



Alan W. Fink, the driving force behind the spectacular rise of the VIC-20 mi-

crocomputer, has left Commodore and joined Kornhauser & Calene Inc., a New York advertising agency.

The agency, which worked closely with Commodore in marketing the VIC-20, hired Fink to head its new consumer electronics marketing group.

Fink: Driving force behind VIC.

According to a statement from Kornhauser, under Fink's guidance, the VIC-20 took only six months to capture a significant share of the personal computer market and made a significant contribution to Commodore's 63 percent increase in fiscal 1982 sales.

"The category of small personal computers is so new that there are few, if any, organizations that can provide the expert marketing assistance needed to sell successfully," Board Chairman Henry Kornhauser said. "Alan Fink provides the vital link in the marketing chain by bringing to clients the manufacturer's viewpoint."

# **Today's engineers** and technicians obsolete in 5 years



WETWARE

Today's design engineers and technicians may be technologically

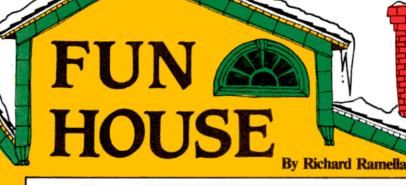
obsolete in three to five years, according to Douglas Bonham, director of Heath/Zenith Educational Division of the Heath Company, Benton Harbor, MI.

Bonham told the T.H.E. Journal technology is changing so fast in the electronics and computer fields that engineers face obsolescence as quickly as the products they design.

In addition, electronics is invading virtually every field where mechanical and electrical equipment used to dominate, forcing many engineers to learn entirely new disciplines.



418 • 80 Micro, December 1982



# Season's Greetings

A s kids and kids in spiritenter the Fun House this month, you can see that I've decorated the place for the holiday season.

Christmas falls as usual on December 25, and Hanukkah starts on December 11 this year. Though the two holidays celebrate different events, there are similarities. Both include decorations, giving gifts, and playing games, somewhat apart from their religious meanings.

So let's have a Fun House party with these programs:

The 12 Days of Christmas is a Color Computer program that celebrates that peculiar story of gift-giving gone wild.

Dreidel is a Level II listing for an ancient Hanukkah game of a spinning top and shifting fortunes. It's pronounced *dray*dul.

Peglegs is my holiday gift to you—a simple, but tricky computer version of a game you may recognize. There are listings for Level II and the Color Computer.

This month's Nickel Bargain Bin is the solution to the

# Twelve Days of Christmas

```
199 REM * 12 DAYS OF CHRISTMAS / TRS-89 COLOR BASIC 4K *
128 DIM A$(24)
     DATA A PARTRIDGE IN A PEAR TREE., TWO TURTLE DOVES
     DATA THREE PRENCH HENS, FOUR CALLING BIRDS
DATA FIVE GOLDEN RINGS, SIX GEESE A-LAYING
    DATA SEVEN SWANS A-SWIMMING, EIGHT MAIDS A-MILKING DATA NINE PIPERS PIPING, TEN DRUMMERS DRUMMING DATA ELEVEN LORDS A-LEAPING, TWELVE LADIES DANCING DATA 12TH,11TH,16TH,9TH,8TH
190 DATA 12TH,11TH,18TH,9TH,9TH,5TH
200 DATA 7TH,6TH,5TH,4TH,3RD,2ND,1ST
210 Z$="204 204 105 193 197 185"
220 Y$="197 204 204 210 197 193 176 185 185 176 176 176 176"
230 X$="204 204 204 210 210 210 200 200 200 204 204 204"
240 W$="147 147 147 147 176 176 176 176"
250 V$="176 185 193 197 185 193 193"
250 V$="176 185 193 197 185 193 193"
260 U$="204 197 193 185 176"
270 T$="197 197 159 170 176"
280 S$="185 176 170 159 147"
290 N=1
300 FOR A=1 TO 24
310 READ A$(A)
320 NEXT A
330 X=31
340 Z=0
350 FOR Y=0 TO 15
369 FOR L=X-Z TO X+Z
370 K=RND(20)
380 IF K<6 THEN SET(L,Y,RND(8)) ELSE SET(L,Y,6)
390 NEXT L
400 2=2+1
416 NEXT Y
420 PRINT @ 322, "THE TWELVE DAYS OF CHRISTMAS "; 430 IF G-50 GOTO 430
448 FOR T=1 TO 1588
450 NEXT T
460 CLS(0)
470 FOR A=12 TO 1 STEP -1
480 PRINT
490 PRINT
              "ON THE "A$(A+12)" DAY OF CHRISTMAS
530 PRINT "MY TRUE LOVE GAVE TO ME:"
     GOSUB 790
568 FOR B=N TO 1 STEP -1
     IF B=1 OR B=2 THEN B$="
     IF N>1 AND B=1 THEN PRINT "AND ";
580
590 PRINT A$(B);
600 IF B=1
               THEN PRINT BS; ELSE PRINT BS
610 IF B>5 THEN AS=ZS
620 IF B=5 THEN A$=X$
630 IF B>1 AND B<5 AND N<5 THEN A$=Z$
640 IF B=4 AND N>4 THEN A$=U$
650 IP B=3 AND N>4 THEN A$=T$
                                             760 NEXT A
660 IF B=2 AND N>4 THEN A$=S$
                                             778 G=58
676 IF B=1 THEN A$=Y$
                                             780 GOTO 330
                                             798 IF N>1 AND B=1 THEN SOUND 193,3
888 POR J=1 TO LEN(A$) STEP 4
689 GOSUB 798
698 U=U+B
700 NEXT B
                                             816 B$=MID$(A$,J,3)
716 PRINT @ 6, "TOTAL GIPTS: ";U
                                             826 P=VAL(B$
                                             830 SOUND P,3
720 N=N+1
730 FOR X=1 TO 500
                                             840 NEXT J
749 NEXT X
                                             850 RETURN
                                             860 END
750 CLS(0)
```



Peglegs game.

started before the hot cider gets cold.

# The 12 Days of Christmas

the events of this Christmas song, someone would wind up with 364 items by the 12th day. running total into this program. It displays the entire song with the melody if you want to sing along. That's all the program does, but that's a lot, considering the length of the listing.

# **Dreidel**

Hanukkah is a Jewish holiday that celebrates the long-ago pieces of Hanukkah gelt in the

100 REM \*DREIDEL / TRS 80 LEVEL II \*

Dreidel

rededication of the Temple of So, fa-la-la-la, and let's get Jerusalem. And Dreidel is a game that children have been playing on Hanukkah for hundreds of years.

This program is given only in If a wild gift-giver duplicated Level II; it simulates a game of Dreidel with the computer playing against a human.

A dreidel is a top with four I found that out when I built a sides. On each side is a letter from the Hebrew alphabet. These letters are shown with this article (see Fig. 1).

> Each player starts with the same amount of Hanukkah gelt—gelt means money—or you can use counters ranging from peanuts to marbles.

To start, each player puts five

main pile. Each player spins the dreidel. These are results of the letters that are face up when the top stops spinning:

- NUN—Nothing happens.
- GIMMEL—Take all the pot.
- HE—Take half the pot.
- SHIN—Give half of what you have to the pot.

When the pot is empty, each player must put five counters in it. The loser is the player who cannot put five counters into the empty pot.

This program includes a spinning dreidel and enough automatic features to make it easy to play.

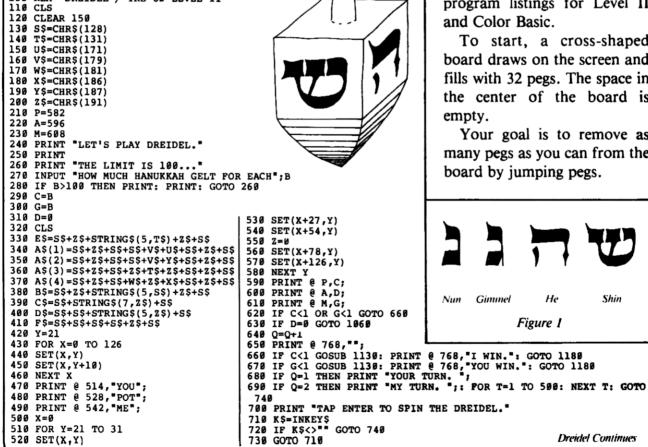
# **Peglegs**

And now it's time to open vour gift.

Peglegs is a computer version of a game that has been around for a few hundred years. I offer program listings for Level II

To start, a cross-shaped board draws on the screen and fills with 32 pegs. The space in the center of the board is

Your goal is to remove as many pegs as you can from the board by jumping pegs.

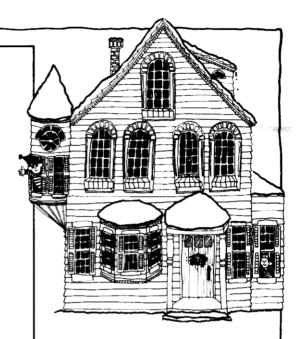


Shin

```
Dreidel Continued
      750 FOR X=1 TO RND(3)
      760 IF X/2 <> INT(X/2) THEN FOR Z=Z TO RND(45)-Z+10
      770 IF X/2=INT(X/2) THEN FOR Z=Z TO RND(10) STEP -1
      780 U=RND(4)
      790 PRINT @ Z,E$;
800 PRINT @ Z+64,A$(U);
      810 PRINT @ Z+128,B$;
      820 PRINT @ Z+192,C$;
      830 PRINT @ Z+256,D$;
      840 PRINT @ Z+320,F$;
      850 NEXT Z
      860 NEXT X
      870 PRINT @ 624,"";
      880 IF U=1 THEN PRINT
                               "NIIN":
      890 IF U=2 THEN PRINT "GIMMEL";
      900 IF U=3 THEN PRINT "HE";
      910 IF U=4 THEN PRINT
                               "SHIN";
      920 PRINT @ 768,"
      930 IF U=1 THEN PRINT "NOTHING."
      940 IF U=2 THEN PRINT "TAKE ALL."
      950 IF U=3 THEN PRINT
                               "TAKE HALF."
      960 IF U=4 THEN PRINT "GIVE HALF."
970 IF U=2 AND Q=1 THEN C=C+D: D=0
      980 IF U=2 AND Q=2 THEN G=G+D: D=0
      990 IF U=3 AND Q=1 THEN I=INT(D/2): C=C+I: D=D-I
      1000 IF U=3 AND Q=2 THEN I=INT(D/2): G=G+I: D=D-I 1010 IF U=4 AND Q=1 THEN I=INT(C/2): C=C-I: D=D+I
      1020 IF U=4 AND Q=2 THEN I=INT(G/2): G=G-I: D=D+I
      1030 GOSUB 1130
      1040 IF Q=2 THEN Q=0
      1050 GOTO 590
      1060 PRINT @ 768,"";
      1070 PRINT "WHEN POT IS EMPTY, WE EACH PUT IN 5."
      1080 C=C-5
      1090 G=G-5
      1100 D=D+10
      1110 GOSUB 1130
      1120 GOTO 590
      1130 FOR T=1 TO 500
      1140 NEXT T
      1150 PRINT @ 768,STRING$(43," ");
1160 PRINT @ 624,STRING$(10," ");
      1170 RETURN
      1180 GOTO 1180
      1190 END
```

# Peglegs

```
100 REM * PEGLEGS / TRS-80 LEVEL II 4K *
110 CLS
120 Q=32
130 U$="JU"
140 D$="JD"
150 L$="JL"
160 R$="JR"
170 Y=3
180 FOR X=18 TO 36
190 SET(X,Y)
200 SET(X,Y+22)
210 NEXT X
220 X=6
230 FOR Y=9 TO 19
240 SET(X,Y)
250 SET(X+42,Y)
260 NEXT Y
270 X=18
280 FOR Y=3 TO 24
290 IF Y<9 OR Y>18 THEN SET(X,Y): SET(X+18,Y)
300 NEXT Y
310 Y=9
320 FOR X=6 TO 48
330 IF X<19 OR X>35 THEN SET(X,Y): SET(X,Y+10)
340 NEXT X
350 FOR Y=5 TO 24 STEP 3
360 FOR X=21 TO 36 STEP 6
    SET(X,Y)
380 NEXT X
    NEXT Y
400 FOR Y=11 TO 17 STEP 3
```



You're a winner if you have two pegs left and you're a double winner if you have only one peg left. You're a triple winner if only one peg remains and its position is the space in the middle of the board.

Now, how do you move around and jump? The Color Computer and Level II versions are slightly different, but this should make both of them clear: In both versions, you move into jumping position by tapping D for down, U for up, L for left, and R for right.

In the color version, your position is marked in blue if you are on a space not occupied by a peg. If you are on one of the occupied spaces, the position will blink on and off.

In the Level II version, your

```
410 FOR X=9 TO 45 STEP 6
420 SET(X,Y)
430 NEXT X
440 NEXT Y
450 RESET(27,14)
460 A=27
470 B=5
480 A$=A$+INKEY$
485 PRINT @ 653,A$;" ";
490 PRINT @ 480,"SCORE";Q;

Peglegs Continues
```

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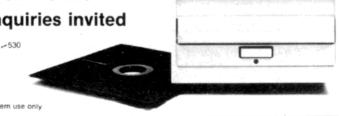
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# Peglegs Continued 500 IF Q=2 THEN PRINT @ 154, "WINNER"; 510 IF Q=1 THEN PRINT @ 90, "DOUBLE"; 520 IF Q=1 AND A=27 AND B=14 THEN PRINT @ 90, "TRIPLE"; 530 IF POINT(A,B)=-1 THEN RESET(A,B): FOR T=1 TO 10: NEXT T: SET (A,B) 540 IF POINT(A,B)=0 THEN SET(A,B):FOR T=1 TO 10: NEXT T: RESET(A,B) 550 IF A\$="U" AND POINT(A,B-2)<>-1 THEN B=B-3: A\$="" 560 IF A\$="D" AND POINT(A,B+2)<>-1 THEN B=B+3: A\$="" 570 IF A\$="L" AND POINT(A,B+2)<>-1 THEN B=B+3: A\$="" 580 IF A\$="R" AND POINT(A-3,B)<>-1 THEN A=A-6: A\$="" 580 IF A\$="R" AND POINT(A+3,B)<>-1 THEN A=A+6: A\$="" 590 IF B-5<4 GOTO 610 600 IF A\$=U\$ AND POINT(A,B-5)=0 AND POINT(A,B-6)=0 AND POINT(A,B -3)=-1 GOTO 690 610 IF B+5>24 GOTO 630 620 IF A\$=D\$ AND POINT(A,B+5)=0 AND POINT(A,B+6)=0 AND POINT(A,B +3)=-1 GOTO 690 630 IF A-9<6 GOTO 650

# Color Peglegs

```
100 REM * PEG LEGS / TRS-80 COLOR BASIC 4K *
118 CLS(0)
120 Q=32
130 U$=CHR$(94)
140 D$=CHR$(10)
150 L$=CHR$(8)
160 R$=CHR$(9)
170 Y=3
189 FOR X=18 TO 36
190 SET(X,Y,5)
200 SET(X,Y+22,5)
210 NEXT X
230 FOR Y=9 TO 19
240 SET(X,Y,5)
250 SET(X+42,Y,5)
260 NEXT Y
279 X=18
280 FOR Y=3 TO 24
290 IF Y<9 OR Y>18 THEN SET(X,Y,5): SET(X+18,Y,5)
300 NEXT Y
310 Y=9
320 FOR X=6 TO 48
330 IF X<19 OR X>35 THEN SET(X,Y,5): SET(X,Y+10,5)
340 NEXT X
350 FOR Y=5 TO 24 STEP 3
360 FOR X=21 TO 36 STEP 6
370 SET(X,Y,8)
380 NEXT X
390 NEXT Y
400 FOR Y=11 TO 17 STEP 3
410 FOR X=9 TO 45 STEP 6
420 SET(X,Y,8)
430 NEXT X
440 NEXT Y
450 RESET(27,14)
460 A=27
470 B=5
480 A$=INKEY$
490 PRINT @ 502, "SCORE"; Q;
500 IF Q=2 THEN PRINT @ 32, "WINNER";
510 IF Q=1 THEN PRINT @ 0, "DOUBLE";
520 IF Q=1 AND A=27 AND B=14 THEN PRINT @ 0, "TRIPLE";
530 IF POINT(A,B) = 8 THEN RESET(A,B):FOR T=1 TO 10: NEXT T: SET(A
,B,8)
540 IF POINT(A,B) <>8 THEN SET(A,B,7): FOR T=1 TO 40: NEXT T: RES
ET(A,B)
550 IF AS="U" AND POINT(A,B-2)<>5 THEN B=B-3
560 IF A$="D" AND POINT(A,B+2)<>5 THEN B=B+3
570 IF A$="L" AND POINT(A-3,B)<>5 THEN A=A-6
588 IP AS="R" AND POINT(A+3,B) <>5 THEN A=A+6
590 IF B-5<4 GOTO 610
600 IF A$=U$ AND POINT(A,B-5)<>5 AND POINT(A,B-6)<>8 AND POINT(A
 ,B-3)=8 GOTO 690
610 IF B+5>24 GOTO 630
620 IF A$=D$ AND POINT(A,B+5)<>5 AND POINT(A,B+6)<>8 AND POINT(A
 ,B+3)=8 GOTO 690
630 IF A-9<6 GOTO 650
640 IF A$=L$ AND POINT(A-9,B)=0 AND POINT(A-12,B)=0 AND POINT(A-
6,B) = -1 GOTO 690
650 IF A+9>49 GOTO 665
660 IF A$=R$ AND POINT(A+9,B)=0 AND POINT(A+12,B)=0 AND POINT(A+
```

position simply blinks, wherever you are.

To jump a peg in the color version, just press one of the four direction arrows on the keyboard. To jump a peg in the Level II version, tap JD for jump down, JU for jump up, JL for jump left, and JR for jump right.

You cannot make any illegal moves, and there are other safeguards built in. You don't have to press enter with this program; the arrow keys do the job.

If you don't understand this yet, run the program and you soon will.

If you can't win, take a look at the Nickel Bargain Bin offer at the end of the column.

Peglegs is tough to beat, but I have a strategy and it's yours for a nickel and a self addressed, stamped envelope. If you want the answer, send the request with a note bearing the words "PEGLEGS SOLUTION" to me, Richard Ramella, 1493 Mountain View Ave., Chico, CA 95926. Do not send the request to this magazine; I am responsible for the offer.

Next month is January, isn't it? No better time than the first of the year to think about time—calendars, timepieces, leap years, and such. So, until 1983...■

```
6,B)=-1 GOTO 690

665 IF LEN(A$)>1 THEN A$=""

670 GOTO 480

690 RESET(A,B)

700 IF A$=U$ THEN RESET(A,B-3): B=B-6

710 IF A$=D$ THEN RESET(A,B+3): B=B+6

720 IF A$=L$ THEN RESET(A-6,B): A=A-12

730 IF A$=R$ THEN RESET(A+6,B): A=A+12

740 SET(A,B)

745 A$=""

750 Q=Q-1

760 GOTO480

770 END
```

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# **General Ledger**

The General Ledger accounting system consolidates financial data from other accounting subsystems in an accurate and timely manner. Major reports include Trial Balance, Income Statement, Balance Sheet, a user-defined report, and more. All data is maintained and reported by month, quarter, year and previous three quarters. Transactions may be entered via direct posting and external posting generated by A/R, A/P, Payroll -- or any other user source.

# **Accounts Receivable**

The objective of a computerized A/R systém is to prepare accurate and timely monthly statements to credit customers. Management can generate information required to control the amount of credit extended and the collection of money owed in order to maximize profitable credit sales while minimizing losses from bad debts. This system is invoice-oriented. Invoices can be entered before they're ready for billing, after billing, or even after they are paid. Accounts Receivable allows entry of new invoices, credit memos, debit memos, or modification or deletion invoice and allows for progress payment. The transaction information includes: type of A/R transaction, P.O. \*\*, description of P.O., billing date, general ledger sales account \*\*, invoice amount, shipping and transportation charges, tax charges, payment, and progress payment information. Reports include: summary or detail listing of invoices not yet billed, open items (unpaid invoices), closed items (paid invoices), and aging. Statements may be printed at any time and follow the format of nationally available forms.

# **Order Entry**

The Order Entry Module was designed as a supplement to the Accounts Receivable Module, and will not operate independently. This system allows you to add, change, delete, list and print invoices; apply an invoice to correct customer account; generate computer assigned invoice numbers; note type (invoice credit memo, debit memo); record customer order number, invoice date, shipping date, FOB location, method of shipping, salesman, and payment terms; print selected number of shipping labels; enter, display and correct 10 lines of data per invoice, noting the part number, description, price, quantity

ordered, extension, taxable or not. It also allows the user to enter, display and correct invoice totals, noting the invoice subtotal, taxes, shipping and handling, with disbursement up to 5 General Ledger accounts; print a transaction report; maintain a terms code file in the system; update Account Receivable and generate summary report totals. It automatically coordinates to the Inventory Module (if used) to determine description, price and out of stock status, and to immediately deplete inventory stock. Price fields are easily modified to include percent or dollar discount.

# **Payroll**

Payroll involves many complex calculations and the production of reports and documents, many of which are required by government agencies. The Payroll system performs all necessary payroll tasks including file maintenance, pay data entry and verification, computation of pay and deduction amounts, and the printing of reports and checks. State and Federal Tax changes are easily implemented by the user via menu prompting. In its link to General Ledger, each employee's payroll information is distributed to as many as 12 different GL accounts; system automatically posts to cash account.

# **Accounts Payable**

The Accounts Payable system receives data concerning purchases from suppliers and produces checks in payment of outstanding invoices. Several reports are available to supply information needed for the analysis of payments, expenses, purchases and cash requirements. The Accounts Payable system is invoice-oriented. It handles new invoices, credit memos and even debit memos and allows modification and deletion of invoices. The flexible check calculation procedures allows checks to be calculated for a set of vendors, specific vendors or even specific invoices. The reports include open item listings and closed item listings (both detail and summary), debit and credit memo listings, aging, check register report (to give an audit trail of checks printed), and vendor listing and vendor activity. Update reports are useful for audit trails and checking for accuracy. Checks may be printed at any time and follow the format of nationally available forms.

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Status reports and minimum reorder reports help to reduce the potential hazard of overstocking which results in cash flow problems. Program selection allows the user to store data for inventory located at up to five separate sites (divisions), coding up to 9 sales people. Available reports include inventory master list, price listings, period and year-to-date sales, stock status, minimum reorder point and commission information.

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Annuity computation program Time between dates Day of year a particular date falls on Interest rate on lease Breakeven analysis Straightline depreciation Sum of the digits depreciation

10 DEPRODE 11 TAXDEP 12 CHECK2 13 CHECKBK1 14 MORTGAGE/A 15 MULTMON 16 SALVAGE

17 RRVARIN 18 RRCONST 19 FFFFCT 20 FVAL 21 PVAL 22 LOANPAY 23 REGWITH

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As above but with quantity price breaks

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- \*\*\* EACH UTILITY PROGRAM IS CALLED UP FROM BASIC USING THE SIMPLE BASIC COMMANDS PROVIDED
- \*\*\* EACH UTILITY PROGRAM COMES WITH A RACET COMPUTES INSTRUCTION MANUAL
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- . MOVE ARRAYS IN MEMORY
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- ALLOWS INSTANT ACCESS TO ANY RECORD ON YOUR DISKETTE
- . INSTANTLY RETRIEVE RECORDS FROM MAILING LISTS, INVENTORY, ACCOUNTS RECEIVABLE OR VIRTUALLY ANY APPLICATION WHERE RAPID ACCESS IS RE-QUIRED TO NAMED RECORDS
- PROVIDES THE BASIC PROGRAMMER THE ABILITY TO RAPIDLY INSERT OF ACCESS KEYED RECORDS IN ONE OR MORE DATA FILES
- . RECORDS ARE MAINTAINED IN SORTED ORDER BY A SPECIFIED KEY
- . RECORDS MAY BE INSERTED OR RETRIEVED BY SUPPLYING THE KEY RECORDS MAY BE RETRIEVED SEQUENTIALLY IN SORTED ORDER
- . RAPID ACCESS TO ANY FILE REGARDLESS OF THE NUMBER OF RECORDS
- . MULTIPLE INDEX FILES CAN BE EASILY CREATED WHICH ALLOWS ACCESS OF A SINGLE DATABASE BY MULTIPLE KEYS (FOR EXAMPLE, BY BOTH NAME AND ZIP-

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# **DSM** (DISK SORT MERGE)

- . SORT AN 85K DISKETTE IN LESS THAN THREE MINUTES!
- . SORTS LARGE MULTIPLE DISKETTE FILES ON A MINIMUM ONE DRIVE SYSTEM
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- . SORTS ON ONE OR MORE FIELDS IN ASCENDING OR DESCENDING ORDER
- . FIELDS MAY BE STIRNGS, INTEGER, BINARY INTEGER OR FLOATING POINT
- THE SORTED OUTPUT FILEMAY OPTIONALLY HAVE FIELDS DELETED. REARRANGED OR PADDED
- . SORT COMMANDS CAN BE SAVED FOR REUSE
- . SINGLE SORT, MERGE, OR MIXED SORT/MERGE OPERATIONS MAY BE PERFORMED
- SORTED OUTPUT MAY BE WRITTEN TO A NEW FILE, OR REPLACE THE ORIGINAL IN-PUT FILE.

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- . USED ISAM (INDEX SEQUENTIAL ACCESS METHOD) FOR RAPID ACCESS TIMES
- YOUR MAILLIST CAN ALWAYS BE SORTED AND MAINTAINED BY UP TO FOUR INDEX FILES (FOR EXAMPLE, NAME, ZIPCODE, DATE AND NUMBER)
- . MAILLIST ALLOWS UP TO 30 ATTRIBUTES TO BE SPECIFIED (TO BE USED IN SEL-ECTION OF SPECIFIED RECORDS WHEN GENERATING REPORTS OR MAILING
- . MAILLIST SUPPORTS BOTH 5 OR 9-DIGIT ZIPCODES
- . PRINTING MAY BE STARTED OR ENDED AT ANY POINT IN THE LIST. THE USER CAN SPECIFY FIELDS OR CODES TO BE PRINTED
- CAPACITY IS 600 NAMES FOR MODEL-1, 3500 NAMES FOR MODEL II, 38,000 NAMES FOR MODEL II WITH HARD DISK DRIVE 1200 NAMES FOR MODEL III

MODEL-I VERSION	.00
MODEL-II VERSION	
MODEL-III VERSION	.00

# **HSDS HARD DISK DRIVE SOFTWARE**

- . MAKES TRSDOS COMPATIBLE WITH MOST HARD DISK DRIVES
- . ADDS MANY EXTRA FEATURES TO TRISDOS.

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• AUTO YOUR DISK TO PERFORM ANY SEQUENCE OF INSTRUCTIONS THAT YOU NORMALLY GIVE FROM THE KEYBOARD (FOR EXAMPLE, INSERT THE DISKETTE. PRESS THE RESET BUTTON, YOUR COMMAND FILE COULD AUTOMATICALLY SHOW YOU THE DIRECTORY, SHOW THE FREE SPACE ON THE DIKSETTE, LOAD A MA-CHINE LANGUAGE SUBROUTINE, LOAD BASIC, LOAD AND RUN A BASIC PROGRAM. AND SELECT A GIVEN ITEM ON YOUR MENU. ALL WITHOUT TOUCHING THE KEY-BOARD!)

MODEL-i VERSION	\$20 00
MODEL-III VERSION	\$30 00
NOT AVAILABLE FOR MODEL-II	

# **DISCAT** (DISKETTE CATALOG SYSTEM)

THIS COMPREHENSIVE DISKETTE CATALOGUING INDEXING UTILITY ALLOWS THE USER TO KEEP (RACK OF THOUSANDS OF PROGRAMS IN A CATEGORIZED LI-BRARY FILE INCLUDES PROGRAM NAMES AND EXTENSIONS, PROGRAM LENGTH. DISKETTE NUMBERS AND FREE SPACE ON EACH DISKETTE KEEP A COMPLETE CATALOG OF THE DIRECTORIES ON ALL YOUR DISKETTES IN ALPHABETICAL ORDER (SORTED ON EACH DISKETTE OR COMPLETE ALPHABETICAL LIST OF PROGRAMS ON ALL YOUR DISKETTES)

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MODEL-III VERSION	\$50.00
MODEL-II VERSION (SEE MODEL-II) UTILITY PACKAGE)	

### **BLINK** (BASIC LINK FACILITY)

- . LINK FROM BASIC PROGRAM TO ANOTHER SAVING ALL VARIABLES
- THE CHAINED PROGRAM MAY EITHER REPLACE THE ORIGINAL PROGRAM OR CAN BE MERGED BY STATEMENT NUMBER

MODEL-I VERSION	\$25 00
MODEL-III VERSION	\$30 00
MODEL-II VERSION (SEE MODEL-II UTILITY PACKAGE)	\$50.00

### INFINITE BASIC

- . ADDS OVER 80 COMMANDS TO BASIC
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MODEL-I VERSION	. \$50 00
MODEL-III VERSION	\$60.00
NOT AVAILABLE ON MODEL-II	

# INFINITE BUSINESS

- . ADD ON PACKAGE TO INFINITE BASIC (REQUIRES INFINITE BASIC)
- ADDS PACKED DECIMAL ARITHMETIC WITH 127 DIGIT ACCURACY (+,0.\*.
- COMPLETE PRINTER PAGINATION CONTROLS, AUTO HEADERS, FOOTERS AND PAGE NUMBERS
- . BINARY SEARCH OF SORTED AND UNSORTED ARRAYS (INSTANT SEARCH OF AN ELEMENT WITHIN AN ARRAY)
- · HASH CODES

MODEL-II VERSION	\$30 00
MODEL-III VERSION  NOT AVAILABLE ON MODEL-II	 \$30 00

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- THE ULTIMATE RENUMBERING PROGRAM. RENUMBERS ALL OR PART OF A PRO-GRAM (ALLOWS PARTIAL RENUMBERING IN MIDDLE OF PROGRAMS)
- PARTIAL OR COMPLETE MERGE OF TWO CASSETTE PROGRAMS

MODEL-I VERSION	\$35.00
MODEL-III VERSION	\$35 00
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# COPSYS

COPY AND VERIFY ALL MACHINE LANGUAGE (SYSTEM) TAPES WRITTEN IN STAND ARD FORMAT. IF YOU BUY A MACHINE LANGUAGE PROGRAM, COPSYS ALLOWS YOU TO EASILY COPY THE PROGRAM ONTO ANOTHER CASSETTE AS A BACKUP

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- DISKS BOOT FASTER TO DOS
- IMPROVE DISK I/O UNDER BASIC

MODEL II ONLY ...



# **MODEL II FASTBACK — FULL DISK BACKUP** IN 55 SECONDS

IN BUSINESS TIME IS MONEY, AND ONE BACKUP IS WORTH A THOUSAND TEARS.

- WORKS ON SYSTEMS WITH 2 OR MORE DRIVES
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MODEL II ONLY



# MODEL-II UTILITY PACKAGE

- ESSENTIAL FOR EVERY MOD-II OWNER
- . RECOVER AND REPAIR FILES AND DIRECTORIES (BY JUST ENTERING A SINGLE COMMAND)
- . XCOPY... SIMILAR TO COPY BUT CAN COPY ANY NUMBER OF FILES AT ONE TIME FASTER AND MORE ACCURATE THAN COPY SINCE RECORDS ARE COPIED IN GROUPS RATHER THAN ONE RECORDS AT A TIME. USING XCOPY YOU CAN COPY FILES THAT CAN NOT BE COPIED USING THE COPY COMMAND
- · SZAP PROVIDES THE CAPABILITY TO READ AND MODIFY ANY SECTOR ON A DISKETTE
- \* XHIT...CAN BE USED TO REPAIR A DISKETTE DIRECTORY
- DCS\_DIRECTOR CATALOG SYSTEM IS A UTILITY FOR THE MANAGEMENT OF USER DISKETTES\_SETS\_OF A MULTIPLE DISKETTE DIRECTORY FILE (WITH UP TO 1200) INDIVIDUAL FILE NAMES). ALLOWS SELECTIVELY LISTED OR PRINTED LISTS OF DIRECTORY FILES IN COMBINED SORTED ORDER (FOR EXAMPLE, LISTED ALPHA-BETICALLY BY DISKETTE. OR A COMPOSITE ALPHABSTICAL LIST OF ALL YOUR DISKETTES
- DEBUG-IL ADDS SEVERAL FEATURES TO THE PRESENT TRSDOS DEBUG UTILITY INCLUDING SINGLE INSTRUCTION CYCLE, AUTO (LOOP) BREAKPOINTS, SUB-ROUTINE CALLING. BREAK-KEY DETECTION AND MANY OTHERS

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# MODEL-II DEVELOPMENT SYSTEM

- THIS PACKAGE IS A MUST FOR ASSEMBLY LANGUAGE PROGRAMMERS.
- INCLUDES THE MICROSOFT EDITOR ASSEMBLER PLUS WITH ENHANCEMENTS FOR THE MODEL-II
- · A COMPLETE DISASSEMBLER
- SUPERZAP FOR READING AND MODIFY ANY SELECTOR ON A DISKETTE

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- LIST OR PRINT A SORTED CROSS REFERENCE TO ALL NUMBERS OR VARIABLES WITHIN A PROGRAM
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Use 1RS label.	Your first name and initial (if joint return, also give spouse's name and initial)	ast name	Your social security number
Other- wise, please print	Present home address (Number and street, including apertment number, or rural route)		Spouse's social security no.
	City, town or post office, State and ZIP code	Your occupation	
or type.		Spouse's occupation	
President Election	Do you want \$1 to go to this fund?	Yes No	<ul> <li>not increase your tax or re-</li> </ul>



# TRS-80\* Owners Do Your Own Taxes Like An Expert with TAX/SAVED II™

\* TRS-80 is a trademark of the Radio Shack Division of Tandy Corp.

# FOR MODEL I. II\*\* or MODEL III

TAX/SAVER II" — The tax help program for the layman, the professional accountant or tax preparer.

New and expanded, TAX/SAVER II\*\* offers a different approach to preparing a tax return. Like the original, the new version has the tax regulations programmed in so it is more than just a calculator. Designed for non-accountants, TAX/SAVER II\*\* asks you questions, just as an accountant does. Based on your answers, it leads you through the tax maze to your lowest legal tax. Then it tells you how to fill in your return, line by line, or it will output to a printer.

TAX/SAVER II\* also has speed features for those doing more than one return. Optional program instruction and tax text make TAX/SAVER II\* the practical system for professional preparers as well. TAX/SAVER II\* has full disk storage of data files (with optional password protection)

The manual includes information on special tax areas, lists of possible deductions and a tax glossary.

TAX/SAVER II\* compares itemized deductions to national averages; automatically computes certain limitations for example, on medical deductions and contributions; checks for excess FICA; helps determine dependents. Yet, TAX/SAVER II\* offers the privacy and convenience of home use.

The user-oriented design with special screen formatting makes data entry, verification and correction easy. Yet you are always in control. You can skip any help features or parts of the program that you don't need.

### TAX/SAVER II"

- AX/SAVER II\*\*

  Completes long and short forms (1040 & 1040A)

  Itemized Deductions Schedule A

  Interest & Dividends Schedule B

  Tax Calculation Tables, Rates

  Tax Savings Methods Income Averaging, Maximum Tax, Alternative Tax

  Business Income Schedule D

  Allows you the privacy of your own home

  Lets you help friends and relatives with their taxes

  Has built-in aids. Answers specific questions like "Is my father my dependent?" and "Are my deductions reasonable?"

  Manual includes 1982 tax forms, information on special tax areas, lists of possible deductions, and glossary of tax terms

  Completes long and short forms including itemized deductions, excess FICA, earned income credit, community property, tax calculation (comparing all possible filing statuses in one run)

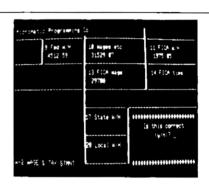
  Tax regulations are programmed in by our team of accountants. Just type in your figures & you've done your own tax return

  Helps you find the lowest tax.

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- Discounts on yearly updates
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# REVIEWS:

- well designed and easy to use" D. Lubar, Creative Computing 1.81.
  TAX SAVER\*\* may very well live up to its name."

  M. Tannenbaum, CPA, 80 Microcomputing 2.81.

# CUSTOMERS:

For the price it can't be beat. Lam looking forward to next year. With this program I finish my filing in 2 hours. Thank you

"Excellent presentation: Tutorial style is one of its most attractive attri-butes. Finally, a program I can really use".

# PROFESSIONALS:

This is the perfect program for the fees. It was obviously written by folks that know both programming and tax law." "TAX SAVER" is superior "

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TAX/FORECASTER\*\*, the quick tax estimator (with printout) for both 1982 and 1983 lets you revise its estimate by merely changing one or more lines. Use it as a tax planner either together with TAX/SAVER II\*\* or by itself. TAX/FORECASTER\*\* lets you quickly ask all of your WHAT IF? Questions and instantly recalculates your taxes. A great tax preparation aid for both the layman and professional. Includes Income Averaging and disk storage of Client files.

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- SYSTEM REQUIREMENTS

  TRS 80 Model I with 32K and 2 disk drives
  TRS 80 Model III with 32K and 2 disk drives
  TRS 80 Model III\* with 64K and 1 disk drives
- \*\* Availability of Model II programs uncertain at press time

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Send any questions or problems dealing with any aspect of TRS-80 microcomputing to "Feedback Loop," 80 Micro, 80 Pine Street, Peterborough, NH 03458.

Twould like to share some comments on Lazy Writer. Contrary to your response to T.B. of Hartford, CT (Feedback Loop, September 1982), Lazy Writer does provide full proportional spacing for several printers, including the DW II.

Also, about the reply to G.B. of Hopkins, MN (also September), Lazy Writer can save formatted text to disk as it would appear on paper; it also has built-in RS-232 communications.

S.B. Frederick, MD

You're right, Lazy Writer does provide proportional spacing. But this is an optional extra (\$29.95 for the DW II), which makes its price substantially more than NewScript (\$124.95 versus \$204.95).

I didn't know Lazy Writer could format text to the disk drives, or that it had an RS-232 driver built-in; for Mr. G.B., that makes it a worthwhile purchase.

I'm writing in response to your answer to E.S. of Los Angeles (September issue) concerning copying disk files from Model III double density to Model I single density. I believe there's a fourth alternative besides the three you mention—Super Utility Plus.

This utility allows the Model III double-disk user to separately format (in several different DOS configurations) each drive and copy files from one to the other. The program costs \$49.95 (cheap and includes many other powerful disk manipulation utilities).

I'm not a machine-language programmer, but I do appreciate Super Utility Plus's ease of operation. I've used it to correct disk errors, rename disks, and make back-ups of protected disks.

> T.B. Spokane, WA

Super Utility Plus is definitely one of the most powerful disk utility programs on the market for the Model I



### Problems and solutions

and Model III computers. I agree with Paul Wiener, every serious user of a TRS-80 Model I or III should have it. But it won't necessarily transfer all programs from one DOS to another. Super Utility Plus is manufactured and sold by Powersoft (11500 Stemmons Fwy, Suite 125, Dallas, TX 75229, 800-527-7432) for \$74.95. The Alternate Source will be selling it at its original price (\$49.95) until January 1, 1983!

I read with interest the letter from P.D. of Nashville (September issue). Coincidentally, we have the same equipment—a Model II with a Line Printer III—and up until a year ago we had the same problem.

Unfortunately, Radio Shack wasn't able to help me. I'm convinced the problem lies with the printer's design. Otherwise I think the LP III is an excellent machine.

Here's what happens: When the printer is programmed to print a character, tension is put on the ribbon. But when you're form feeding, only line feeds go to the printer. When the form is feeding through, the ribbon is loose. The trouble comes when the perforation between the forms passes in front of the print head, catches the loose ribbon, and pulls it away from the print head. At \$13 per ribbon, that's an expensive problem.

Once I understood the problem, the solution was easy. I program the printer to print a dot at column 80 one line before the perforation and one line after the perforation. This puts enough tension on the ribbon to keep it out of

the way. I've added this feature to all our programs with 100-percent success. I can now leave my printer on all night long printing five-part forms with carbons.

For unalterable canned programs, you have to devise a way to put enough tension on the paper so the perforations don't pull the ribbon, while making sure the tension won't tear the tractor-feed holes.

T.S. Chicago, IL

Sounds like an excellent, nontechnical solution for modifiable programs. Does anyone have a working solution for the nonmodifiable programs?

In your reply to R.M. of Poland, OH, you listed two machine-language manuals for the 6809 chip. There's a third book available: 6809 Assembly Language Programming by Lance A. Leventhal, published by Osborne-McGraw Hill Publications.

P.W. Jaffrey, NH

Thanks for letting us know.

I am considering a switch from my Stringy Floppy and tape system to disks, but I need more information before I will buy. Can you tell me the advantages and disadvantages of 40 versus 80-track drives, double-headed drives, and double-density drives. I intend to use the system for business activities such as inventory and accounts receivable.

W.G. West Berlin, NJ

The primary advantage of 80 over 40-track drives is space—there's twice as much of it. The disadvantage is some incompatibility with software on 35 and 40-track disks. Most of the incompatibility problems come about because 80-track drives actually put two tracks in the same space normally occupied by only one track of a 35-track disk.

An 80-track drive would treat a 40-track disk as if it were an 80-track disk where every other track was a duplicate of the preceding track. This presents a problem when you try to read a disk because the boot-up sector of a

disk usually tells the DOS where the directory track is located. The 40-track disk tells the DOS the directory is on track 17, so the 80-track drive skips over to its track 17 (actually track 8 of the 40-track disk) and gets lost trying to find the directory.

Several DOSes on the market (MULTIDOS, DOSPLUS, to name two) include a command, Skip, that takes care of this problem, allowing you to read the 40-track disk. Writing to the 40-track disk is also okay if you don't try to read the disk in a 40-track drive later (which will read the new 80-track information alongside the old 40-track information, and get confused).

The problem still remains for those programs on protected disks that can't be treated as data disks. These special DOS disks require that you boot them up in a 40-track drive. To leave yourself the most flexibility, I suggest you get one 40-track drive to use with those special programs.

The double-headed drive's advantage is, once again, space. Double-headed drives store twice as much data in the same amount of space. The disadvantages are that they cost more (single-sided disks can be used, but the second side isn't guaranteed to be good and you could experience lost data problems), and most DOSes let you use only three drives on a system with a double-sided drive, with the fourth drive line being used to switch between side A and side B (but who cares when you end up with 50 percent more room than a standard four-drive system).

Double density lets you store almost twice as much information as with single-density drives. I don't know of any real disadvantages to double density. In fact a double-density board will improve the reliability of disk I/O in single density on a Model I just by being installed (double density requires the use of a data-separator circuit for the FDC chip controlling the disk drives). This data separator reduces, if not eliminates, DATA-LOST errors.

If you were to get one double-sided, double-density, 40-track drive and two 80-track double-sided, double-density drives, you would have about 1.4 megabytes (18\*40\*2 + 18\*80\*4 = 5760 sectors) of information on-line, compared with 400,000 bytes on a standard four-drive, 40-track, single-density system.

I've been considering buying the Radio Shack PC-2 Pocket Computer. I haven't because Tandy doesn't have an editor/assembler, or even an instruction set, for Assembly-language programming—despite giving an example of a short machine-code routine in their manual. I was told their machine is identical to the Sharp Pocket Computer and that Sharp doesn't want to release the instruction set either. I asked a Sharp salesman, but he didn't know anything. Can you shed any light on the matter?

P.S. I'm a great fan of LCD displays, and am curious to know about the possibility of pocket computers in the future with larger displays (more than one line of text). Maybe portable is a better word than pocket.

J.W. Albuquerque, NM

The PC-2 is the Sharp Pocket Computer with Tandy's label on it. The Sharp salesman can't be blamed for not knowing because deals of this nature are conducted at a higher level of management.

An editor/assembler isn't available for either Pocket Computer. You are correct about why Tandy doesn't sell one for their PC-2. If Sharp, the licensing company, allowed them, Tandy most assuredly would sell an editor/assembler. After all, they've released one for all their other computers.

Trade journals have been talking about new LCD multiline displays for microcomputers the past few months. It shouldn't be long before we see a portable computer similar to the Kaycomp or the Osborne 1, except that it will have a light-weight LCD display instead of a 15 or 20-pound video monitor.

My system is a Model I, Level II ALPS keyboard with 16K, an LNW expansion interface with AeroComp Doubler, two MPI B-52 drives, and a Centronics 737 printer.

I'm unable to read most disks formatted on other systems. When I try to boot them, the disk spins, stops, and the screen retains its previous image. If I connect someone else's drive to my system (using my power supply and cabling), one out of every five drives tried will load. Disks made on my system won't load on most other systems. I have swapped drives, power supplies, and cabling. The only item that seems to

make a difference is the drive.

I've used my drives and interface on other systems and they work just fine.

I think there's a tremendous disparity in the speed and head-alignment adjustments for mini-drives. I haven't found anyone who can check and align my drives, so I don't have any real proof yet. Also, there seems to be some drive/interface interplay that I don't fully understand; they work fine separated, but not together.

M.B. Laguna Beach, CA

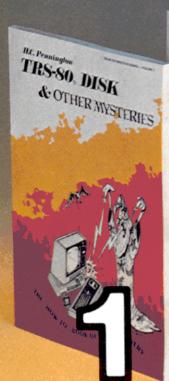
Ouch! It does sound like your problem is with the disk drives and their alignment. There are two commercially available programs that can help you identify the problem. The most versatile is Floppy Doctor by Dave Stambaugh (The Micro Clinic, 17375 Brookhurst, #114, Fountain Valley, CA 92708, \$24.95/Model I, \$29.95/Model III). Floppy Doctor is a complete diagnostics package. It thoroughly checks your computer system: RAM, ROM, and drives (35, 40, 77, and 80 track, single and double density). The drives are checked for proper motor speed, head alignment, read/write accuracy, headseek accuracy, and several other important areas. If you don't already have this program, get it. It will tell you if the problem is with your drives, disks (I test for flaws on any new disks I buy), computer, or software. Knowing which tests your drive fails can sometimes pinpoint the exact cause for your drive's problems.

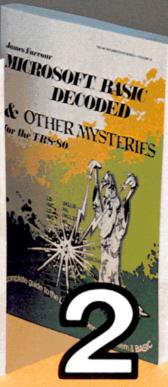
The other diagnostic package is DDT-Disc Drive Timer from DiscoTech (1150 Coddingtown Center, P.O. Box 11129, Santa Rosa, CA 95406, \$29.95). This utility uses a graphic chart to show you your drive's rotation speed, and tells you how to adjust that speed to within normal system tolerances.

There is another possibility—check your disk drives to see if they both have the termination pullup resistor pack installed. Only the last drive on your drive cable should have it. If you're not sure where the resistor pack is, take both drives to a computer repair center and have the technician tell you if the resistor pack is installed properly.

I've been so flustered by Radio Shack's EDTASM that I've almost given up. I have a problem saving the object output from the assembly onto

## As Easy As...









#### TRS-80 Disk & Other Mysteries

by H.C. Pennington

This book is the definitive authority on data recovery for the TRS-80 Model I disk system. In almost every case, lost data can be recovered and this book tells you how to do it. From clobbered directories to parity errors, this profusely illustrated data recovery cookbook includes examples and step-by-step instructions for both beginners and professionals.

132 pages. \$22.50

#### Microsoft BASIC Decoded & Other Mysteries

by James Farvour

This book is the only one of its kind. You will learn how the TRS-80 Model I BASIC works from interpreter power-up to power-down. It has the complete disassembled Microsoft BASIC Level II interpreter with over 13.000 lines of detailed comments in one volume. The math, arithmetic and utility routines are fully explained with examples on how to use them. An incredible learning aid for the beginner and a valuable reference for the professional.

312 pages. \$29.95

#### The Custom TRS-80 & Other Mysteries

by Dennis Bathory Kitsz.

A comlete hardware/software how-to-do-it like reverse video, high res graphics, audible keystrokes, 8-track mass storage music synthesizer, and real time clock. Dozens of project hints, tips, and fixes complete with the interface software. If you are a beginner, there are chapters on wire-wrap, soldering and construction methods. If you are a professional, there is a wealth of technical detail.

332 pages. \$29.95

#### BASIC Faster and Better & Other Mysteries

by Lewis Rosenfelder

BASIC is not nearly as slow as you think! This book shows you how to make it faster and better with techniques and tricks that you never dreamed of for Model I, II and III disk systems. You won't find trivial, poorly designed "checkbook" programs here - only useful BASIC techniques and code ready for use in YOUR programs. Tutorial for the beginner, instructive for the advanced, and invaluable for the professional. All routines are available on disk.

290 pages. \$29.95

Learn about your TRS-80 computer – it's as easy as 1–2–3–4. These books are easy to read and understand because they are written for you by people just like you. Here are answers and solutions without jargon. There are no end of chapter "tests" – no incomprehensible math formulas – no textbook explanations – just straightforward, plain English.

You will learn how to recover "lost data" on disk, how the BASIC interpreter works, how to make BASIC run faster and better, and how to modify and interface your TRS-80. In other words, you will learn how to make your computer do all the things you want it to do. It's as easy as 1–2–3–4.

Available at computer stores, B. Dalton Booksellers and independent book dealers. BASIC Faster and Better is also available at all RADIO SHACK Computer Centers and selected RADIO SHACK stores. (Cat. No. 62-1002) If your dealer is out of stock, order direct. Include \$4.00 for shipping and handling. Foreign residents add \$11.00 plus purchase price, in U.S. funds.

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	disk	\$59.95
0369RD3	Easy Calc 48K, Mod III only, disk	\$49.95
0269RD	Easy Calc 48K, Mod I only, disk	\$49.95
0103R	Personal Bill Paying 16K, Mod I & III,	
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5005RD	Master Directory 32K, Mod I only,	
	disk	\$29.95
0152RD	Business Analysis 32K, Mod I & III,	
	disk	\$99.95
0140R	Business Analysis 32K, Mod I & III,	
	tape	\$75.00
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	III, tape	\$14.95
0309R	Triangle Trig 16K, Mod I & III, tape	\$19.95
0071RD	Geography Explorer: USA 32K, Mod I	
	& III, disk	\$49.95
0276RD	Geography Explorer: Mid East, 32K,	
	Mod I & III, disk	\$49.95
0111R	Word Watch 16K, Mod I & III, tape	\$14.95
0257R	Math Master 16K, Mod I & III, tape	\$17.95
0127R	Surveyors Apprentice 16K, Mod I & III,	
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#### GAMES 0332R S

0017R

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0148A	Air Flight Simulation 16K, Apple, tape	\$14.95
0159R	Jet Fighter Pilot 16K, Mod I & III, tape	\$14.95
0329AD	Jet Fighter Pilot 32K, Apple, disk	\$24.95
0223R	Cosmic Patrol 16K, Mod I & III, tape	\$19.95
0224RD	Cosmic Patrol 16K, Mod I & III, disk	\$24.95
0237R	Danger in Orbit 16K, Mod I & III, tape	\$19.95
0247RD	Danger in Orbit 16K, Mod I & III, disk	\$24.95
0051R	Ball Turret Gunner 16K, Mod I & III,	
	tape	\$14.95
0240R	Alien Attack Force 16K, Mod I & III,	
	tape	\$14.95
0171R	Flight Path 16K, Mod I & III, tape	\$14.95
0043R	Santa Paravia 16K, Mod I & III, tape	\$14.95
0229AD	Santa Paravia 48K, Apple, disk	\$24.95
0273TI	Santa Paravia 16K, TI 99/4, tape	\$14.95
0174A	Santa Paravia 48K, Apple tape	\$14.95
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0378RD	Master Reversi 16K, Mod I only, disk	\$24.95
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0183A	Skybombers III 32K, Apple, tape	\$14.95
0271AD	Skybombers II 32K, Apple, disk	\$24.95
5020RC	Tower of Fear 16K, Color Computer,	
	tape	\$19.95
0084R	Music Master 4K, Mod I & III, tape	\$14.95
0106R	Air Mail Pilot 16K, Mod I & III, tape	\$14.95
0205RD	Flying Circus 32K, Mod I only, disk	\$39.95
0163AD	Paddle Fun 32K, Apple, disk	\$19.95

0325RD 0387RD	Mission: Mud 32K, Mod I & III, disk Sparrow Commander 32K, Mod I & III,	\$19.95
	disk	\$19.95
0386RD	Kitchen Sink 32K, Mod I & III, disk	\$19.95
0161AD	Apple Fun 32K, Apple, disk	\$19.95
UTILIT	IES	
UTILIT 0230R	IES TLDIS 16K, Mod I & III, tape	\$19.95
		\$19.95 \$24.95
0230R	TLDIS 16K, Mod I & III, tape	

House of 30 Gables 16K, Mod I & III,

0230R	TLDIS 16K, Mod I & III, tape	\$19.95
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5700RD	Super>>Terminal 32K, Mod I & III,	
	disk	\$95.00
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0232R	The Disassembler 16K, Mod I & III.	
	tape	\$14.95
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cassette. EDTASM works fine except for this one area. I have both Version 1.0 and Version 1.1 for tape systems, but both have this problem.

My system is a Level II, 16K computer with the dual cassette interface from Sel-tronics. I removed the interface from the system, but still have the problem. I tried the computer store, Fort Worth, and friends with no luck. I'm considering getting EDTASM Plus, but am worried about the cassette operation.

B.B. San Jose, CA

It sounds like the cassette interface in your keyboard is at fault. Most of the early Model Is had a flaw in the design of the cassette interface that made it very difficult for the computer to read from and write to cassette tape. For a time Radio Shack offered a free modification to the cassette interface that corrected this problem (the XRX cassette modification). The modification is still available, but now they usually charge a nominal fee for the parts and labor.

Before you charge off to the nearest Tandy computer retail center, check these points out first:

Are your tape recorder heads clean and properly aligned? Borrow a friend's recorder and see if you have better luck saving and loading. If you do, the problem is most likely with your tape recorder and not EDTASM or your computer.

Have you tried using your copy of EDTASM on another computer (such as the local Radio Shack store's or a friend's)? If your EDTASM works on other computers, the problem is with your system. If the EDTASM fails to work at the store, show the salesman and get a replacement copy.

If you have chronic problems with cassette I/O, regardless of the program or tape recorder you're using, the problem is definitely with your cassette interface and should be taken to a repair center.

I have a PMC-80 with a built-in cassette recorder. In the August issue of 80 Micro there's a game called Naval Wars. To connect the computers together you need the mike, remote and earphone plugs exposed, which aren't available on the PMC-80. If you plug a plug into the computer a second tape player can be accessed by the normal

I/O statements. Is it possible to convert the program to work on the PMC-80? D.H.

Conway, PA

After looking at the program, I don't see why you can't just replace the INPUT#-1 and PRINT#-1 commands with INPUT#-2 and PRINT#-2 and use the second tape player plug on the PMC-80. If you're going to be playing with another PMC-80, both machines will need the modified program. If the other machine is a TRS-80, use the modified program in your machine only.

I have a Model III 48K cassette-operated computer, with a Radio Shack LP VIII. I use the computer for word processing with Scripsit, which is where I have my problem. The LP VIII is capable of changing type fonts, underlining, and printing boldface characters, none of which are supported by Scripsit.

A friend told me about a cassette program, "Scrips Plus," that corrects this problem, but I can't find the software company, Quality Software, who's supposed to be one of your advertisers.

Another problem I have is line renumbering in Basic. On my PC-1 this is easy to do. The need often arises to either replicate or duplicate some programming without retyping. I have seen renumbering mentioned in ads; are there any subroutines that you've published in the past that can change line numbers easily?

> D.P. Houston, TX

The Scripsit modifying program you want is called Scriplus, for Scripsit. The company that sells it has changed its name from Quality Software to Power-Soft (11500 Stemmons Fwy, Suite 125, Dallas TX 75229), which is why you couldn't find them in the magazine. Scriplus retails for \$24.95 (cassette or disk) and lets you use all your printer's features: backspace, underline, boldface, and so on.

There's another Scripsit-modifying program available called Scriptr. It's sold by Pioneer Software (1746 NW 55th Ave., #204, Lauderhill, FL 33313) and retails for \$40 (cassette and disk).

For more details on both of these programs, read pages 101 and 102 of the September 1982 issue of 80 Micro.

I think you have a slight misconception about renumbering programs. The

PC-1 is unusual in its method of renumbering Basic lines. Most Basic linerenumbering programs change the line numbers of your Basic program to a new sequence. They don't move or duplicate the Basic lines. Several of the DOSes on the market (such as DOSPLUS and MULTIDOS) include special commands in their DOS Basic that let you move or duplicate Basic lines. But since you don't have disk drives, that isn't a solution (and the only renumbering program I can find in the magazine is in the March 1981 issue, page 256).

What you can do is get a machinelanguage program that lets you use screen-editing techniques to duplicate Basic lines to new locations (almost exactly the same way the PC-1 duplicates lines. You just type a new line number over the old one, press enter, and you've duplicated it.) There are two of these available. The first one is called IRV and is sold by The Programmer's Guild, (P.O. Box 22, Peterborough, NH 03458 (603) 924-6065) and retails for \$24.95 (Model I cassette version). \$29.95 for disk. The Model III version is called Superkeys and retails for \$49.95 (disk only). It's available from Advanced Operating Systems (450 St. John Road, Suite 792, Michigan City, IN 46360, (219) 879-4693).

The second program is sold by Interpro (P.O. Box 4211, Manchester, NH 03108, (603) 669-0477) and retails for \$24.95 (specify disk or tape). It automatically adjusts itself to your computer's memory size (16K, 32K, or 48K), and computer type (Model I or III).

Both programs let you assign messages to the keyboard keys (so you can define the shift, D key combination to print "Delete," the shift, X key combination to print Data \*\*\*\*\*\*\*\*\*\*\*\*\*\*, and so forth) and let you use the standard Level II Edit commands together with their screen-editing capabilities to concatenate or change Basic lines on the screen.

Of the two programs, Key Commander is more sophisticated and versatile; it's also easier to use.

We're looking for information on the Color Computer: books, programs, hardware, software, and computer clubs. We're also interested in a program called Smart Package, which is supposed to allow direct linking to other computers without the use of CompuServe. Can you help?

R.&K.J. Madera, CA

Your best source of information on the Color Computer is 80 Micro (this isn't just a plug for this magazine, it's the truth). 80 Micro has more companies advertising products (books, programs, hardware, and such) for the Color Computer than either of the two publications specializing in the Color Computer (Color Computer News, and The Rainbow). Check September's Feedback Loop for two machinelanguage books on the Color Computer, and this month for a third one.

One very good source is B. Dalton Books, located in many shopping malls. B. Dalton has the largest and most complete selection of computer books of any store I've ever been in, including computer stores.

New computer club listings can be found in 80 Micro issues, with an updated list printed each year of all the clubs known. 80 Micro's November 1981 issue included as complete a listing as possible. It will be updated in the Anniversary issue. In addition, the Radio Shack Computer Newsletter also lists new clubs.

The Smart package is probably a communications program, although I can find none with that name. Several similar programs are available: Datapak (Cer-Comp, 5566 Richochet Ave., Las Vegas, NV 89110, \$24.95 cassette, \$49.95 disk), Colorcom/E (Spectrum Projects, 93-15 86th Drive, Woodhaven, NY 11421, \$49.95), Micro-Text (The Micro Works, P.O. Box 1110, Del Mar, CA 92014, \$59.95 ROMPAK), Colorterm (Martin Consulting, 94 Macalester Bay, Winnipeg, Manitoba, R3T 2XT Canada, \$34.95), and Super Color Terminal (Nelson Software Systems, P.O. Box 19096, Minneapolis, MN 55419, \$39.95 tape, \$49.95 ROMPAK, \$69.95 disk).

These programs make the world of telephone and computer communications available to the Color Computer user. CompuServe, Timenet, and The Source are all data-base computer networks you can tie into using a communications terminal program. When you buy the CompuServe package from Radio Shack, you get one hour of time on CompuServe and a rather primitive communications program. CompuServe isn't necessary to communicate

with other computers—only the terminal program (and a modem/phone hardware hookup) are needed for that. There are several hundred computer bulletin board services in the world. Many of their phone numbers have been listed in past issues of 80 Micro.

I want to upgrade my TRS-80 Level I computer without paying Radio Shack prices. I've worked with electronics, but not computers. Is there any alternative from another company, or a doit-yourself ROM pack? I've put in my own 16K RAM.

L.H. Cortland, NY

The only source of Level II ROMs is Radio Shack, which sells them for \$99 and charges \$25 to install them. If you don't mind voiding your Radio Shack warranty, you can buy the ROMs from Radio Shack's National Parts Division (900 East Northside Drive, Fort Worth, TX 76102, (817) 870-5662). The twochip Level II ROMs cost \$66.73 (the A-B chip, serial number AXX3031, is \$41.58, the C chip, serial number AXX3030, is \$15.15). If you have MasterCharge or Visa, you can call direct and order the parts by phone. There's also a \$1.50 shipping and handling charge.

I bought my Model III in November 1980, and after the warranty expired, I upgraded it to 48K and then added a non-Radio Shack disk drive. all of which operate flawlessly. The problem is with my keyboard. About eight months ago the I key stuck in the on position. A half hour with a screwdriver and ohmmeter convinced me that the only problem was a stuck keyboard switch—one bad key module. I tried but couldn't get a replacement module. After several phone calls I gave up and swapped the failing key module with the period module from the numeric key pad.

I continued looking, but couldn't find either a single key module or a keyboard at any price. I was told that I could order a module, but after three months I gave up. Finally I was told that Radio Shack doesn't sell keyboards over the counter; I would have to bring in my machine for service and they would replace the necessary parts.

I'm a little leery of taking my machine with its \$700 dollars of alien hardware to Radio Shack (I've heard the

horror stories of people getting their computers back with their homebrew modifications in a bag). And why should I surrender my machine to a repair center and pay for parts and labor (not to mention down time), when I could easily repair it myself?

> R.C. Hyattsville, MD

Yes, you can buy a new keyboard from Radio Shack. All you do is order it from National Parts (see previous letter for the address information). The Model III keyboard's serial number is AXX0205, and costs \$68.56. It shouldn't take more than two weeks for the part to be delivered. (They usually promise store delivery in three work days.)

I'm having a few minor problems with my TRS-80 Model I monitor. The image on my display shows a small ripple that travels slowly from the bottom of the screen to the top, and then starts again. Also, the whole image on the screen is shifted to the right approximately ¼" to ½", making the rightmost part of the image fuzzier than the rest. Finally, the monitor sometimes squeals from the inside. The noise is similar to what you hear from a color tv, only louder. Can you help me with these?

H.L. South Bend, IN

Anyone having difficulties with a Model I/III computer system should buy Dennis Kitsz's book, *The Custom TRS-80 & Other Mysteries* (available from the *80 Micro* Bookshelf, advertised in this magazine. Ask for catalog number BK1218). The book retails for \$29.95.

All three problems are covered in *The Custom TRS-80*, pages 253-254. The first problem isn't the fault of your computer, but is the result of radio frequency interference (RFI) from another device. The most common source of this problem is the triac used in light dimmers. The second most common source of interference comes from fluorescent light bulbs, followed by failing neon bulbs (usually stereo lights); in a business, check your copier. This is one of the hardest problems to eliminate because the problem originates from outside the computer.

The second problem can be corrected by opening the keyboard unit (Warn-



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The TC-8C has a spare EPROM socket on the board. You can install either 2716 or 2732 EPROM's. This memory space can be used for any of your application programs or you could install the optional JPC Products monitor program - JBUG.

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The TC-8C and the JBUG Monitor come with complete and extensive user manuals (JPC's documentation is praised almost as highly as our hardware and software). Complete command descriptions and background information are provided. Examples and sample programs are provided to help the novice and experienced individual take full advantage of the TC-8C and the JBUG Monitor.

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ing: Opening the computer will void your Radio Shack warranty) and adjusting the horizontal and vertical control potentiometers on the right side of the keyboard, facing down with respect to the normal operating position of the keyboard.

The last problem is only a nuisance. The high-voltage lines are experiencing a slight arcing problem. The solution is to open the case (same warning as above), after letting it sit unplugged for an hour to let the power supply capacitors discharge safely, and clean the insides. If you find the hissing irritating, take it to the repair shop and have them put more dope on the high voltage lines. If you know where these lines are yourself, and you have the right kind of dope, you can do this yourself.

My TRS-80 screen starts to scroll and gets wavy when I fill it with graphics (i.e., white-out the screen). What's wrong? How can I fix it?

J.H. Grosse Ponte Park, MI

First, get Dennis Kitsz's book (the same one mentioned before). Second, the video monitor has to be modified to fix this problem. Unplug the monitor an hour before you begin. (Warning: Not only will opening the case void your warranty, but if you don't let the monitor sit unplugged for an hour before starting, the voltages you'll find inside could kill you.) After removing the case, locate the resistor marked R14 on the small circuit board closest to the side of the case (some monitors only have one). The resistor should be marked 3.3K ohm (orange, orange, red bands marked on the resistor). Solder a 1.5K ohm resistor on top of the 3.3K resistor (making them parallel to one another). Put the cabinet back together. This should take care of your problem.

While reading some 80 Micro back issues, I noticed several programs with different version numbers, such as Star Trek 4.0. How are the version numbers arrived at?

M.C. Concord, NH

They make them up. Star Trek 4.0 was written several years before Adventure International's Star Trek 3.5. Generally, unless the program is written

by the same author, the version number is meaningless. If the same author is using different version numbers, the numbers correspond to the program's release sequence, thus Scripsit Version 1.1 is an improvement of Scripsit Version 1.0

My almost new, yet out of warranty, Radio Shack Modem I recently died. Repair charge: \$56.

Radio Shack claims the damage was caused by a power surge and is not the fault of their equipment. I would like to know if this is a plausible explanation or am I being sandbagged. Also, how can I prevent this from recurring?

E.M. Birmingham, AL

Yes, this is possible. I have had the unfortunate luck to see most of a TRS-80 computer destroyed by a line-voltage power surge. Radio Shack sells a power-line filter/multiple outlet box for \$49 that will limit the amount of ac power line interference your system gets. Many other companies, advertisers in this magazine, offer surge protectors and spike suppressors for your computer. Since you've already been zapped once, you'd better get one of these right away.

I've decided to add lowercase capability to my Model I, but I don't have any instructions or a schematic. I do have an SPST switch and a 2102 RAM chip. Can you help?

I'm also considering upgrading my system to include disk drives and double density, but I'm worried about compatibility with other computers. If I have 40-track, double-density drives, will I be able to exchange programs on disks with someone who has only Radio Shack 35-track, single-density drives? Would it help if both parties operated under the same DOS?

H.S. Cincinnati, OH

The Custom TRS-80 by Dennis Kitsz has the procedure on how to install lowercase capability (as well as about half the questions in this month's column).

Compatibility isn't a problem if you use 40-track drives and a DOS capable of reading and writing in single and double density. All you have to remember to do is to format and write the exchange disk as a 35-track, single-density disk. DOSPLUS, LDOS, NEWDOS-

80, and MULTIDOS all read and write to both single and double-density, 35 or 40-track disks. Of the bunch, MULTIDOS offers the most advantages for its price: MULTIDOS is the only DOS that reads and writes to disks no matter what system they were written with (although NEWDOS80 is a problem if the directory is more than one track in length). For the most compatibility, both operators should use the same DOS.

I am a blind freelance writer and have thus far been unable to use my husband's 48K Model I tape-based computer. Our quest for help to get the computer to read out in an audio medium has been long and frustrating. Other blind users I know of use Apples. My ultimate goal is to have a word processor I can use.

Do you know of an easier way to accommodate an audio medium other than dissecting and modifying each program to be used with it? Can you suggest a way to turn our 80 into a word processor I can use?

N.K. Forked River, NJ

My first thought was to call IJG Computer Services (1260 West Foothill Blvd., Upland, CA 91786, (714) 946-5805) and ask about the progress of Talking Pencil, a word processor for the visually handicapped. Unfortunately, while they have plans to eventually release such a product, the processor is barely out of the planning stages.

The next step was to call the Votrax Corp. (500 Stephenson Hwy, Troy, MI 48084, (313) 588-0341). Votrax makes a device called Type 'N Talk, which takes ASCII text input from an RS-232 port and converts it into speech (it works quite well). However, it requires software to direct the data to the RS-232 from the main program (as well as control codes to determine when and what to send). Unfortunately, again, the results were negative; no one at Votrax was aware of a word processor using the Votrax unit.

Other phone calls also failed to provide a solution. Since I couldn't seem to help you, does anyone else know of a solution for N.K.'s problem?

Terry Kepner is a free-lance writer and programmer, and the vice president of Interpro. He's been writing about microcomputers since 1979.

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DOUBLE FEATURE

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By Roger Schrag

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I'm sure the options market was invented by brokerage firms because it allows those with small bankrolls to gamble. If you wish to trade options here are the rules.

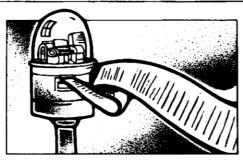
An option is the right to buy or sell 100 stock shares at a set price called the "striking price." All listed options have an expiration date. At any time before the expiration date they may be bought and sold each market day. All options expire at 3 p.m. EST on the third Friday of the expiration month.

A "call" is an option to buy 100 shares of the stock. A "put" is an option to sell 100 stock shares.

An "exercise" converts an option to the actual stock. The option holder (buyer) can convert to stock at any time, provided he has the money to pay for it. For example, if you bought a November 30 call on XYZ last June for \$200, and today XYZ is at \$37 per share and you want to get the stock, your option, \$3,000, plus a commission gets you 100 stock shares. You have exercised your option. In practice, few options are exercised. Most investors who own XYZ options on November 30 would sell in the market for about \$700.

"In the money" refers to an option, like the XYZ above, which has some tangible value. That is, the stock is above the striking price.

"Out of the money" is an option with no tangible value; that is, the current stock price is below the striking



## Explore your options

price. The price it commands will depend on how much time is left before expiration and how close the stock price is to the exercise price.

You are "covered" when you sell an option on a stock you own. This is the least risky investment in the market. (See one of my previous columns where I go into covered option writing in depth.) You are also covered if your options are properly spread. I'll get into that later.

"Naked" is when you sell an option on stock you don't own, and if the holder exercises it, you are forced to buy the stock at the current market price in order to deliver to the option holder. Being naked implies unlimited risk. If you sell an option on ASA with a striking price of 30 and ASA goes to 90, you are stuck. Of course, if you have any judgment, you will have covered your naked position by buying the option back.

The strategy of simply buying an option is obvious. If you think a stock is going up, you buy a call. If you are bearish, you buy a put. Program Listing 1 assists you in determining if an option is over or underpriced.

Another strategy that I employ frequently is "spreading." This is when you buy one option and sell another on the same stock.

XYZ is at 23. You think it will go to 30 by February, so you buy the February 25 outright for about \$200 per option and concurrently sell the February 30 for about \$75. You put up the same \$200 for the February 25, but you get back \$75 from the sale of the February 30, making your net risk \$125. This is an example of "vertical spread."

In many cases I prefer spreads. It is true that you give up the potential for an enormous move in a short time, but over many years, I have determined that few stocks rise more than 33 percent in any 90-day period. Therefore, I prefer the spread because I think the odds favor it. Figure 1 clearly shows the vast advantage spreading has for even a 45 percent move-up in the stock. Should the stock remain under 25, both calls will expire worthless. If you are considering buying a call that is way out of the money (buying a 50 call on a stock that is now at 40), the vertical spread portion of Fig. 2 will make spreading a compelling strategy.

Using the "calendar spreads" strategy requires the least investment. An example would be selling a February (nearby) and buying a May (deferred) option. As this is written, there are over 25 stocks on which this can be done for under ½ or \$50 per spread. For example: Today you can buy the Mesa Petroleum April 20 and sell the MSA January 20 for a debit of only 1/4 or \$25 per spread. MSA closed today at 14. The risk is that what you put up as the April option must always be worth more than the January. Should MSA be at 20 on the third Friday of January. the option you sold would expire worthless while the one you bought has

Compare outright purchase of an option vs concurrently selling a higher priced one.

The calculations assume equal dollar investment in each. Profit or loss at expiration. Current stock price 23, investment \$200.

AT EXPIRATION	OUTRIGHT	SPREAD	% STOCK GAIN
\$25 PER SHARE	<b>- 200</b>	- 200	8
\$26 PER SHARE	- 100	<b>-40</b>	13
\$27 PER SHARE	0	120	17
\$28 PER SHARE	100	280	21
\$29 PER SHARE	200	440	26
\$30 PER SHARE	300	600	30
\$31 PER SHARE	400	600	34
\$32 PER SHARE	500	600	39
\$33 PER SHARE	600	600	43
\$34 PER SHARE	700	600	47
\$35 PER SHARE	800	600	52
\$36 PER SHARE	900	600	56

Figure 1

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90 days to go and would be worth about 2 to  $2\frac{1}{4}$ —a profit of perhaps 1,000 percent. Even if MSA is only at 17, the April 20 should be worth at least  $\frac{1}{2}$  for a 100 percent profit. If MSA is unchanged at 14, it is likely you will be able to recover most of your investment. The program in Fig. 2 tells you what the option would be worth with 90 days to go if the stock is unchanged.

Several times each year a situation develops that can provide the clever investor with an opportunity for big profits with essentially zero risk. Examine the following illustration. Teledyne recently sold for 75. For a brief period you could have bought one October 90 and one October 110 and sold two October 100s for a net credit of 3/8. That is, the proceeds from the sale of the two October 100 calls paid in full for the October 90 and 110 with 3/8 left over, nearly paying the commission. You put up nothing. (Note: One of the October 100 calls is uncovered and requires margin money, or if you have any marginable securities in your account, they will stand good for the margin required.)

Check out this arithmetic. If on the third Friday of October, TDY sells for less than 90, all the options expire worthless. The investor lost nothing. If TDY is between 90 and 110, the investor profits. The maximum profit is achieved at 100, for then the 100 and the 110 options are worthless and the 90 is worth 10, or \$1,000. If TDY is above 110, the investor loses only a commission as the combined value of the 90 and 110 equals the value of two 100 options.

You're not laughing now! The order to the broker was, "TDY, buy calls 1 October 90 and 1 October 110. Sell calls 2 October 100 at 3/8 credit." This is one area where established brokers may get executions that the discounters can't touch. Your broker will be surprised that such opportunities exist.

There is another strategy that I have successfully employed. Today Warner Communications (WCI) closed at 37. There is an option (actually a warrant on the American Exchange) that gives one the right to buy one share of WCI at \$55 per share anytime up to April 1, 1986. It closed at 13 3/8. The more conservative investor might consider buying the stock and selling (shorting) the war-

```
Program Listing
15 FOR I=1 TO 1800: NEXT
20 CLEAR: REM IF YOU WANT ONLY THE VERTICAL SPREAD PROGRAM TYPE RUN 5000
30 IF PEEK(293)<>73 THEN POKE 16553,255: REM SEE IF MODEL 1
40 POKE16419,196: CLEAR1000: DIM A(300): CLS: T$="###.##": Z=100
: A(110)=0: GG=1: DIM S$(100)
50 INPUT "CURRENT PRIME RATE (14% AS 14)";I
60 INPUT "CALENDAR SPREAD=1 VERTICAL SPREAD=2 ELSE ENTER"; CS:
CLS
70 PRINT "COMPARE ESTIMATED PRICES WITH ACTUAL OPTION PRICES.
80 INPUT "SYMBOL OF STOCK"; SS$
90 CLS: PRINT @459,"I'M LOOKING IN DATA BANK FOR "; SS$
100 READS$,V
110 IFSS="END" THEN CLS: PRINT SSS;" IS NOT IN DATA BASE, ENTER VOLITILITY.": PRINT "ENTER A NUMBER FROM 5 TO 60": PRINT "5 FOR
UTILITIES UP TO 60 FOR MOST VOLATILE";: INPUT V: GOTO 130
120 IFS$<>SS$ THEN 100
130 CLS: INPUT "ACTUAL PRICE OF FIRST OPTION."; HP
140 INPUT "ACTUAL PRICE OF SECOND OPTION"; LP
150 PRINT "FIRST OPTION (LOWER STRIKING PRICE, OR LONGER OPTION
160 PRINT "TOUCH A 1 FOR PUT OR A 2 FOR CALL": GOSUB900
170 IFVAL(Q$)>2,CLS: PRINT "BAD ENTRY, TRY AGAIN": GOTO 160
180 A(105) = VAL(Q$)
      INPUT "
190
                   # DAYS TO EXPIRATION
                                                               ":D1: M=D1/30
      INPUT "
200
                   STRIKING PRICE
                                                                 ";A(101)
210
      PRINT "SECOND OPTION (HIGHER STRIKING PRICE, OR SHORTER OPT
ION):
220 PRINT "TOUCH A 1 FOR PUT OR 2 FOR A CALL": GOSUB900 230 IFVAL(Q$)>2 THEN CLS: PRINT "BAD ENTRY, TRY AGAIN."
240 A(106)=VAL(Q$)
250 INPUT # D
                   # DAYS TO EXPIRATION
                                                              ";D2: N=D2/30
      INPUT " STRIKING PRICE
INPUT "CURRENT STOCK PRICE
      INPUT "
                                                                 ";A(102)
260
270
      INPUT "QUARTERLY DIVIDEND (40 CENTS AS .40)
                                                                 ":D: D=D*4
290
310
      PRINT
320 CLS: PRINT @410,"I'M THINKING"
      IF A(105) = 1 THEN A$="PUT IF A(105) <> 1 THEN A$="CAI
330
                              A$="CALL"
340
35₿
      IF A(106) = 1 THEN B$="PUT
      IF A(106) <>1 THEN B$="CALL"
360
       I=I/Z: V=V/Z: D=D/Z: T=M/12: U=N/12
370
380
       A(61) = T * .5: A(62) = \emptyset
390
         A(60) = (T/A(61) - A(61)) * .5
400
      IF (A(60) =0) + (A(60) =A(62)) THEN420
410
         A(61) = A(61) + A(60): A(62) = A(60): GOTO 390
      IF U=0 THEN A(63)=0
A(63)=U*.5: A(62)=0: A(60)=(U/A(63)-A(63))*.5: GOTO 450
420
430
       A(60) = (U/A(63) - A(63)) *.5
440
450
      IF (A(60) = 0) + (A(60) = A(62)) THEN 470
460
       A(63) = A(63) + A(60):
                                A(62) = A(60): GOTO 440
      IF A(102) = 0 THENA(102) = 5
IF A(101) = 0 THENA(101) = 5
470
480
490
      FOR J=101 TO 102
      IF A(J+4)=1 THEN Q=A(J)+(A(J)-P)
500
      IF A(J+4)=1 THEN A(30)=Q/A(J)
520
      IF A(J+4) <> 1 THEN A(30) = P/A(J)
530
      IF J=102 THEN A(61)=A(63)
540
      IF J=102 THEN T=U
       A(36) = LOG(A(30))
550
56Ø
       E=A(36)+(I-D+.5*V*V)*T
570
        E=E/(V*A(61)): F=E-V*A(61): A(40)=(D*T)*(-1): A(45)=EXP(A(61))
40))
       A(48) = A(45) : A(50) = E
580
590
      GOSUB810
600
      IF A(J+4)=1 THEN 620
       A(J+2)=A(48)*P*A(52): GOTO 630
610
620
       A(J+2) = A(48) *Q*A(52)
630
       A(40) = (I*T)*(-1): A(45) = EXP(A(40)): A(48) = A(45): A(50) = F
640 GOSUB810
       A(J+2) = A(J+2) - A(48) *A(J) *A(52)
650
    IF A(J+4)=1 THEN A(J+2)=A(J+2)*.8498
IF II=1 THEN GOTO 980
660
680 NEXTJ
690 CLS: PRINT @330, "OPTION EVALUATIONS ON STOCK SYMBOL "; SS$
700 PRINT @420, "ESTIMATED ACTUAL
710 PRINT @420, "ESTIMATED ACTUAL
710 PRINT @448, "";: PRINT " # 1 VALUE OF";D1; "DAY, $";A(101);A$;
" = $";: PRINT USING T$;A(103);: PRINT " ";: PRINT USING T$
;HP
720 PRINT " # 2 VALUE OF";D2; "DAY, $";A(102);B$;" = USING T$;A(104);: PRINT " ";: PRINT USING T$;LP
                                                                     $":: PRINT
 USING T$; A(104);: PRINT "
730 PRINT STRING$ (64,131)
740 X1=HP-A(103): X2=LP-A(104): O1=INT(100-((A(103)-X1)/A(103)*1
00))
                                                                        Listing continues
```

rant. You put up the difference (23 5/8). As long as WCI is above about 24, you can't lose. Anything above 24 is net profit. Maximum profit occurs at 55 or above. A similar situation exists in American Express (AXP).

If you want to buy a stock that has listed options, you may be able to artificially create (so to speak) the stock by using options, and in the process, save money. Last week Teledyne TDY was at 79. The April 80 call and the put were selling for 12. I wanted 1,000 shares of TDY, but rather than put up \$79,000, I bought 10 April 80 calls and sold 10 April 80 puts. I have essentially all the profit potential and risk of owning the stock. The difference is that I put up no money. My \$79,000 can be earning interest for the next eight months (about \$6,300). At expiration, if I still want to own the stock, I can exercise my call option and buy it for 80 even though it may be at 110 (would you believe 130?). If I choose to sell the call I must pay capital gains taxes. There is no tax if I exercise.

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r 424

```
Listing continued
 750 O2=INT(100-((A(104)-X2)/A(104)*100))
 760 IFO1>0 THEN RS="OVERVALUED": GOSUB910 ELSE R$="UNDERVALUED":
   GOSUB910
 770 GG=GG+1: IFO2>0 THEN R$="OVERVALUED": GOSUB910 ELSE R$="UNDE
 RVALUED": GOSUB910
 780 IFM>3 OR N>3 THEN GOTO 970
 790 IFOP=1 THEN 930
800 PRINT @975,"";: INPUT "PRESS ENTER TO CONTINUE"; E$: CLS: IFC
 S=2 THEN H=A(101): L=A(102): A=P: GOTO 5100 ELSE 20
810 A(53)=1/(1+.231642*ABS(A(50)))
        A(40) = -A(50) *A(50)/2: A(45) = EXP(A(40)): A(51) = .398942 *A(45)
  820
         A(55)=1.330027: A(56)=1.82126: A(57)=1.78148: A(58)=.35
  830
  6564
  840
         A(59) = .319382
        A(52) = (((A(55) *A(53) -A(56)) *A(53) +A(57)) *A(53) -A(58)) *A(53
  85Ø
         A(52) = A(52) + A(59): A(52) = 1 - A(51) * A(53) * A(52)
  860
  870
       IF A(50)>=0 THEN890
  889
        A(52) = 1 - A(52)
  890
       RETURN
  900 Q$=INKEY$: IFQ$="" THEN 900 ELSE RETURN
  910 IFO1>66 OR O2>66 THEN OP=1
920 PRINT "OPTION # ";GG;" IS ";R$;" BY ";ABS(O1);"%": O1=O2: RE
  TURN
  930 U$=INKEY$: IFU$="" THEN PRINT @0,"ONE OVERPRICED BY MORE THA
  N 66%.": GOTO 940 ELSE IF CS=2 THEN H=A(101): L=A(102): A=P: GOT
  O 5100 ELSE 40
  940 PRINT "SOMEBODY THINKS THEY KNOW SOMETHING...TAKEOVER?????"
  950 PRINT "SPREAD OPPORTUNITY, OR PERHAPS AN EXCELLENT COVERED W
  RITE???"
  960 PRINT "TO CONTINUE TOUCH ANY KEY": GOTO 930
  970 IFM>3 THEN M=3: N=3: T=M/12: Y$="1ST": II=1: GOTO 380 ELSE
  N=3: U=N/12: Y$="2ND": II=1: GOTO 380
  980 IF CS=1 THEN II=0: PRINT @832, WITH 90 DAYS LEFT THE ";Y$;"
OPTION SHOULD BE WORTH "; ELSE 790
990 IFY$="1ST" THEN PRINT USING T$;A(103): GOTO 790 ELSE PRIN
     A(104): GOTO 790
  5000 REM
               LINE 5000 TO 5260 CAN BE A STAND ALONE PROGRAM FOR
               EVALUATING OUTRIGHT PURCHASES VS VERTICAL SPREADS
```

#### COMMISSIONS HAVE BEEN OMITTED

5010 REM

5250 IFI<L+1 THEN P=Q-S3

THE CALCULATIONS ASSUME AN EQUAL INVESTMENT IN BOTH THE OUTRIGHT AND SPREAD POSITION. IN PRACTICE THIS MAY NOT BE POSSIBLE BUT IS SHOWN FOR ILLUSTRATIVE PURPOSES.

IN CALLS PROFIT/LOSS WILL LESS FAVORABLE AS

```
5020 CLEAR: CLS
5030 PRINT "COMPARISON OF OUTRIGHT PURCHASE VS VERTICAL SPREAD"
5040 PRINT "COMPARISON OF COURTGHT PURCHASE VS VERIFICAL TO SOLD A 35 5050 PRINT: INPUT "PRICE OF STOCK IN DECIMAL"; A 5060 INPUT "PRICE IN DECIMAL OF HIGHER PRICED OPTION"; HP
5070 INPUT "STRIKING PRICE"; H
5080 INPUT "PRICE IN DECIMAL OF LOWER PRICED OPTION"; LP
5090 INPUT "STRIKING PRICE"; L
5100 S3=HP-LP
5110 U=HP-LP: U=HP/U
5120 CLS: INPUT "WANT PRINT OUT OF OUTRIGHT VS VERTICAL ENTER A
1";PO
5130 CLS: PRINT "PROFIT/LOSS AT EXPIRATION. STOCK PRICE "; A; "INV
ESTMENT $"; HP=100: PRINT "THE CALCULATIONS ASSUME AN EQUAL INVES
TMENT IN EACH STRATEGY
5140 IFPO=1 THEN LPRINT "THE CALCULATIONS ASSUME EQUAL DOLLAR I
NVESTMENT IN EACH. ": LPRINT "PROFIT OR LOSS AT EXPIRATION. CURR ENT STOCK PRICE "; A; " INVESTMENT $"; HP*100: LPRINT "." 5150 PRINT 0129, "AT EXPIRATION OUTRIGHT", "SPREAD", "% STOCK
GAIN
5160 IFPO=1 THEN LPRINT "AT EXPIRATION
                                                             OUTRIGHT", "SPREAD"
,"% STOCK GAIN
5170 FOR I=H TO H+11
5180 J=(I-A)/A*100
5190 GOSUB5240
5200 PRINT "$";1;" PER SHARE
                                           ":INT(O*100),INT(P*U*100),INT(J)
 5210 IFPO=1 THEN LPRINT "$";I;" PER SHARE
                                                             ":INT(0*100),INT(P
*U*100), INT(J)
5220 NEXT
5230 INPUT "GO BACK TO MAIN PROGRAM=1 ANOTHER VERTICAL SPREAD=2"
 ;V: IFV=1 THEN 40 ELSE 5020
 5240 O=O-HP
```



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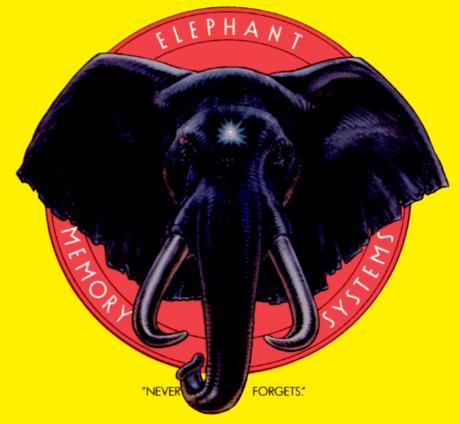
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This month's "Notes from Beneath the Keyboard" is special. Kim Watt once told me what a luxury it was to work with Vernon Hester. He said you didn't need a disassembler with Vernon around, because Vernon could read a page of op-codes as easily as mnemonics. He also said, "Vernon Hester is the king of TRS-80 disk I/O. I know some people have attributed that honor to me, but Vernon's the real one."

If you use any of Vernon Hester's software, you probably share my belief that Vernon is one of the grandmasters of TRS-80 disk I/O. This month, I'm broadcasting the voice of the master. I think you'll agree that Vernon's programming perspicacity rivals his teaching talent. Vernon will tell us a hitherto unpublished method of disk I/O. At first glance, the technique might seem similar to other one-byte I/O techniques. However, Vernon's offering is unique because it uses ROM calls to eliminate the greatest stumbling block to compatibility with a variety of DOSes.

**Vernon:** A lot of people have learned how to read and write sectors from disk. There has been a problem writing the last sector, or end-of-file (EOF) byte.

That gets tricky when you're working with a multitude of DOSes. What no one has detailed is exactly how one who doesn't want to get too involved in a DOS can write a simple routine that will correctly write a file, byte for byte, from RAM to disk, or read a file from disk to RAM, with the proper end of file, and with the proper end byte.

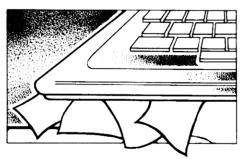
Those calls are available in the ROM. If you make those calls in the ROM, the particular DOS being used will do its own end-of-file and next-byte manipulation, and correctly write the proper end of file and end-of-file byte.

**Paul:** When you talk about end of file, and end-of-file byte, you're referring to potential compatibility problems because of the way in which different DOSes handle those things, right?

Vernon: Right.

**Paul:** Now, are those the major or only incompatibility problems? If someone's application program has disk I/O and those two things come out right, is it fairly certain everything else will?

**Vernon:** Yes. What a lot of people have probably confused a one-byte read or a



## Disk I/O with V. Hester

one-byte write with is a logical record length of one. The programmer still has control over what his logical record length is. Unless you have a specific need, such as random files from Basic, I don't see why you shouldn't have a logical record length of (256(?)). But other than that, most programs work on a logical record length of 256.

**Paul:** Does a logical record length of 256 ensure that a 256-byte buffer is filled before a sector is actually flushed to disk?

Vernon: Yes.

**Paul:** So that keeps things relatively quick.

Vernon: Yes.

**Paul:** Some people are concerned that this type of byte I/O is slow. You said once before that it does use system-verify automatically, so writes can take a little longer. But otherwise, it's about the same as any technique that writes a sector at a time. Is that correct?

Vernon: Yes. It depends on what you're trying to read or write. If you're trying to read or write a file that fits in RAM, it's not going to take much time. Especially reading it, because it only reads and writes full sectors; it doesn't read or write partial sectors.

In other words, the way DOSes work, you can only read in a sector. What DOS does, in a one-byte read, is to read an entire sector the first time it accesses that sector. The accumulator will contain the sector's first byte. Then,

if you call the one-byte read again, it doesn't read the sector again, it positions the buffer pointer one byte up. Once that sector is finished being read in, DOS will read another sector.

Paul: That's done automatically with the same ROM call. When you do the call, you don't have to know if the buffer pointer is in the middle of a sector or the end of a sector. You do it the same way?

**Vernon:** You do it the same way. The DOS handles it. Every time you read a byte, although the accumulator contains that byte, it also contains a zero-flag condition. If the zero flag is not set by a read, you jump to a little routine I call End of File. If the accumulator contains a 1C hex, it's read in everything and you are at the end of file; otherwise, you have an error.

What you do is call the one-byte read. You jump-relative if the byte read is nonzero to your get-error routine. Otherwise, you move the byte in the accumulator to wherever in memory you're reading. For example, I point the HL register at the memory I want to read. Then I load the target of the HL register (the location where the HL is pointing) from the accumulator, increment the HL, and jump right back to the onebyte read routine. When I end up with an error, I compare with 1C hex. If you have a 1C hex, you have read in what you want to read in. Otherwise you can set bit 6 and jump to 4409 hex. That's a DOS error-handling routine. The only reason you set bit 6 is so you won't see DOS ERROR = error number.

**Paul:** Do you get the DOS error message at all then?

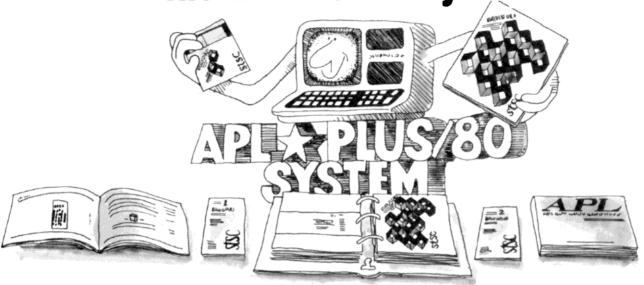
**Vernon:** If you jump to 4409 you will. **Paul:** With bit 6 set you get an error message but not the error number?

**Vernon:** Right. If you don't have bit 6 set, you'll get DOS ERROR = 24. Most DOSes, when you're in the DOS ready mode and you input an illegal or bad file name before it jumps to 4409, will set bit 6. To set bit 6 I do an OR 40H. It's a little faster.

I've written a routine that will both read and write a user program, text, or whatever.

At line 14000 you have a label called Start: Define label FBUF plus 20H. It's the first byte to write. Model III TRSDOS has a 50-decimal-byte DCB. In

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	RANDOMT						
[1]	'RTABLE:	S' []FC	REATE :	10 O I	<b>+</b> 1		
[2] L	: (3 702	(2100)	JEAPPE!	WD 10	♦ +(15	≥ <i>I</i> + <i>I</i> +1	) pL
4							
∇	SHOWTAB	LE N;M					
[1]	'16' [F	IJ.M TN	1]+/[1	]M+M.+	/M+CIPR	EAD 10	, N
∇							•
	RANDOMT	ABLES <	SHOW:	TABLE	12		
89	1	45	30	84	50	100	399
52	8	93	13	99	40	77	382
14	69	29	96	3	44	68	323
155	78	167	139	186	134	245	1104

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that case you define that FBUF plus 32H. **Paul:** So, if you're not pressed to save a few bytes and you're not sure what DOS is going to be used, you can allow for a 50-byte DCB buffer and preserve all-around compatibility, right?

Vernon: Right. At line 17000, we define the label Mode. Mode will tell you whether you want to read or write. When you enter this program, you jump to or call the label Disk. Before you do that, Mode must contain the proper value to specify a read or write. A few other locations must be correctly loaded as well. Start and Finish (lines 14000 and 15000) must be loaded for a write, and Where (line 16000) must be loaded for a read. The name of the file to read or write must be set up in memory. I'll get to all that as we follow the program flow.

Line 18000 defines your I/O buffer. I arbitrarily used 5300H as one page above the file DCB buffer (the label FBUF, line 13000).

At line 19000, I set the origin up. You have plenty of room here. The label I have is Disk. Load DE with FBUF. That points DE at the DCB. Then we call FILK. That checks for a valid file name.

**Paul:** Does the user have the file name in a buffer when this routine starts?

Vernon: The file name can be anywhere in memory when he enters the routine. The HL had to be pointing at the file name's first character. The file name has to be terminated by 03 or 0DH. If HL contains 6000H, the name should be there (at 6000H) terminated by 03 or 0DH

Paul: And that's what's getting checked when you call FILK?

**Vernon:** Right. In other words, if HL is pointing to 1234567, that's an invalid file name. There would be a nonzero condition on return from FILK.

The next instruction is jump-relative on nonzero to BADNAM. The comment there is "nonzero if bad name."

The next instruction is load HL with the I/O buffer. That's where to read or write sectors from or to. I set that to 5300H.

Line 24000 is load B with zero. That sets a logical record length (LRL) of 256. Paul: What do you use for logical record lengths other than 256?

Vernon: Whatever you want to use. Load B with 24 and you'll have a logical record length of 24.

Paul: And loading B with one would

give you a logical record length of one? **Vernon:** Yes.

Paul: And 255 would be 255?

**Vernon:** Right. There's a gotcha on LRLs other than 256, though.

Paul: What's that?

Vernon: You need two buffers.

Paul: Maybe for simplicity, you should keep it as 256 then.

Vernon: Okay. Load A with the contents of Mode to determine if you're going to read or write. If it's a zero, you want to write. If it's a nonzero, you want to read. The way you check that is with the next instruction at 26000 and 27000: Or A. Jump-relative to RDISK if A is nonzero.

If you get to line 28000, you know

you're going to write a file, so we call INIT. That will initialize a (new) file, or overwrite an existing one (with the same file name). This is what the HL is originally pointing to—this text (file name). You can have whatever valid file name you want. You can have file name, slash, extension, decimal point, password, colon, and drive number if you wish. And if you don't have a drive number, it's going to search for the nonwrite-protected disks, starting at drive zero.

The next instruction (at line 30000) is "jump-relative to UERR if nonzero." That occurs if there is an error.

The next instruction is load HL with the contents of Start. That's the first

		40000	- DUT			
0013		00000 01000		DEFL	13н	ROM INPUT ONE BYTE
227		02000	KONKD	<i>DD</i> 1 <i>D</i>	2711	FROM DEVICE
001B		03000	ROMWT	DEFL	1BH	ROM OUTPUT ONE BYTE
		04000				; TO DEVICE
402D		05000	DOS	DEFL	492DH	; ENTRY TO 'DOS READY'
4489			ERROR	DEFL	4409H	; ERROR INTERPRETER
		87666				A CONTAINS ERROR CODE
441C		08000 09000	FILK	DEFL	441CH	;MOVE FILE FROM @ (HL) TO ;@ (DE), CHECK FOR VALIDITY
4420		18898	INIT	DEFL	4420H	:INITIALIZE FILESPEC
4424		11889		DEFL	4424H	OPEN EXISTING FILESPEC
4428			CLOSE	DEFL	4428H	CLOSE FILE
5200		13000	FBUF	DEFL	5200H	; FILE DCB
5232		14000	START	DEFL	FBUF+32H	; FIRST BYTE TO WRITE
5234			FINISH	DEFL	START+2	; LAST BYTE TO WRITE
5236			WHERE	DEFL	FINISH+2	WHERE TO READ INTO
5238		17060		DEFL	WHERE+2	; NON-ZERO = READ
5300		18000	IOBUF	DEFL ORG	5300H MODE+1	;SECTOR BUFFER
5239	110052	19000	DICE	LD	DE, FBUF	;PUT DE @ DCB
	CD1C44	21000	DISK	CALL	FILK	CHECK FOR VALID FILENAME
523F		22000		JR	NZ, BADNAM	NON-ZERO IF BAD NAME
	210053	23000		LD	HL, IOBUF	WHERE TO READ/WRITE SECTORS
5244	9699	24000		ĻD	B, 0	; LRL=256
	3A3852	25000		LD	A, (MODE)	;WHAT TYPE
5249		26000		OR	λ	NOV FERO - BELD
524A		27000		JR	N2,RDISK INIT	; NON-ZERO = READ ; INIT FILE
524C	CD2044	29888		CALL	INII	OVERWRITE IF EXISTING
524F	2019	30000		JR	NZ, UERR	; IF NON-ZERO SHOW ERROR
	2A3252	31999		LD	HL, (START)	FIRST BYTE TO WRITE
	ED4B3452	32000		LD	BC, (FINISH)	LAST BYTE TO WRITE
5258		33000	MORE	LD	A, (HL)	GET BYTE
5259	CD1B@8	34000		CALL	ROMWT	PUT IT INTO BUFFER
		35000				DOS WILL WRITE SECTOR
	200	36000			NO UEDD	TO DISK WHEN FULL. FIF NON-ZERO SHOW ERROR
525C 525E	200C	37000 36000		JR PUSH	NZ,UERR HL	SAVE POSITION
	ED42	39000		SBC	HL,BC	ARE WE DONE?
5261		48888		POP	HL	RESTORE POSITION
5262		41000		INC	HL	; INCREMENT ONE POSITION
		42000				; INC HL DOES NOT EFFECT
		43000				; "2" FLAG!
	20F3	44000		JR	NZ, MORE	; IF NON-ZERO MORE TO WRITE ; CLOSE FILE
	C32844	45000		JP LD	CLOSE A,13H	;13H = IMPROPER FILE NAME
	3E13 F640	47999	BADNAM	OR	40H	MASK TO PROHIBIT
320N	1040	48000	OLIKK		40	'DOS ERROR = XX'
526C	C38944	49000		JP	ERROR	GET ERROR MESSAGE
	CD2444	50000	RDISK	CALL	OPEN	OPEN EXISTING FILE
	2 <b>0</b> F6	51000		JR	NZ,UERR	; IF NON-ZERO SHOW ERROR
	2A3652	52000		LD	HL, (WHERE)	GET PLACE TO PUT IT
	CD1300		GDISK	CALL	ROMRD	GET BYTE: IF END OR ERROR = NON-ZERO
527A 527C	2994	54000 55000		JR LD	NZ,EOF (HL),A	; PUT THE BYTE
5270	"	56000		שני	(112) /11	WHERE YOU WANT IT
527D	23	57000		INC	HL	; INCREMENT POSITION
	18F7	58000		JR	GDISK	GET MORE
	PEIC	59000	EOP	CP	1CH	; IF 1CH NATURAL EOF
5282		68888		RET	2	GO HOME IF OK
	18E5	61000		JR	UERR	; SHOW ERROR
5239		62000		END	DISK	

byte you want to write to. Start contains the address of the first byte to which you want to write.

The instruction at 32000 loads the BC register with the contents of Finish. That's the last byte you want to write.

Now you have a label. This label is More, and it's "load A with the contents of HL." The comment there is "Get the byte."

The next instruction is call ROMWT (ROM Write). That puts it in the buffer.

The next instruction (line 37000) is "jump-relative to UERR if nonzero." If something went wrong, you go to the error-handling routine.

Next you push HL to save the position to which you just wrote. Then at line 39000, subtract-with-carry the HL from BC.

**Paul:** To see how much you have left? **Vernon:** Right—well if it's zero or not. Then you POP the HL to restore the pointer. Then increment the HL to position it at the next byte. Now remember, this increment HL does not affect the flags at all. If I'd increment H or increment L it would affect the flags. But in-

crementing a full 16-bit register does not.

At line 44000, jump-relative if non-zero to More. The zero flag is still in the state it was left by the subtract-with-carry in line 39000. So you'll go through this routine until the HL reaches the BC, or in other words, until I have written the last byte to write. And after that you jump to close.

Paul: Let's see if I understand this. The user doesn't even have to break the data up into 256-byte chunks. It automatically gets transferred to the output buffer 256 bytes at a time?

**Vernon:** I think it gets transferred to the I/O buffer one byte at a time.

**Paul:** It gets flushed to disk and then the pointer gets reinitialized to the beginning of the I/O buffer?

Vernon: Right.

**Paul:** The user doesn't have to worry about any of that.

Vernon: Not at all.

Next (line 46000) you have the label BADNAM (Bad Name). Load A with 13H. The comment there is "13H indicates an improper or illegal file name."

The next label is UERR. The instruc-

tion is OR 40H. That's so you won't have this DOS ERROR = xxx message. **Paul:** That's the bit 6 thing.

**Vernon:** It's the same as setting bit 6, right. The next instruction is Jump to Error, which will assemble as Jump 4409H.

Now, if you want to incorporate the routine into your own program instead of ORing with 40H, you OR with C0H. Then, whatever you've written can make a call to this routine. When it jumps to Error, it will display the error message and return. But if you OR with only 40H (you don't have bit 7 set), it will jump to 402D and you'll be back at DOS Ready. That is internal in DOS's error-handling overlay.

Paul: ORing C0H sets bit 7?

**Vernon:** Yes, and bit 6. If you want to see DOS ERROR = xxx and still return to the calling routine, you can OR 80H. That's the end of the error-handling routine.

Now you go back to the label RDISK at line 50000. This time you're going to read from disk. Now before you got here from above, you've already called FILK, which has positioned the file



name from the target of the HL to the DCB pointed at by the DE. You've already set the logical record length to 256 by loading B with zero. Then you checked the mode. The mode was nonzero, so you jumped down to this label RDISK. What you do there is to call Open.

If you're going to read a file, it has to already exist. So unlike INIT, Open won't create a new file for you. But it will find an old one with the given file name. The next instruction is "jump if nonzero to UERR." That means there's an error. Either the file doesn't exist, or something went wrong. The next instruction is Load HL with the contents of Where. That gives the place to store the data that is read in.

The next label, at line 53000, is GDISK. The instruction is Call ROMRD. That gets a byte. The first time the program encounters this instruction, it will do two things: It will read in a sector to the I/O buffer, and it will put into the accumulator the first byte of the data read into the buffer. On subsequent calls, it will put into the accumulator the next byte on queue in the buffer.

The next instruction is "jump-relative if nonzero to EOF." Nonzero can mean two things. It either means you read in everything, or you had an error. If you don't encounter a nonzero condition, you fall through to line 55000 where you load the memory location pointed to by HL with A. That puts the byte into your designated read-in area. Then you increment HL and jump-relative back to GDISK. It keeps going through this loop until an error occurs or the EOF is reached.

At line 59000, you have the label

EOF: Compare 1CH. The comment is "IF 1CH Then Natural End of File." Then return if zero—go home if okay. Otherwise, jump-relative to UERR, the error-handling routine. That's it.

Now let's talk about the program a bit. There are four labels that are very important to this program. I've established them at particular points, but they don't have to be there. They are Start, Finish, Where, and Mode. They are consecutive labels.

The user, if he wants to write something, has to know where he wants to

> " Vernon Hester is the king of TRS-80 disk I/O."

start writing it from, and where he wants to finish writing it from. He must put a value in Start, which is a 16-bit word. For example, Start can contain 0000 and Finish can contain 2FFFH. Then we would write the ROM out to a disk file, provided Mode contains a zero.

If, on the other hand, you want to read a disk file into RAM, you have to establish the Where address of where you want to start reading it into. This routine doesn't check for TOPMEM (HIGH\$) or anything like that. You can do that another way. But, if you want to start reading something into 6000H, you'd put 6000H into the contents of

Where, and you'd put a nonzero into the contents of Mode.

When you call this routine, as I've said, HL should point to the file name. What you can do is to put another label in here called FILNM (file name). The first instruction is to load DE with the file buffer:

20000 LD DE,FBUF

You can then load HL with file name

20500 LD HL,FILNM

That's the only maintenance required. Paul: When I want to read in a file, do I have to specify the correct logical record length (LRL)?

**Vernon:** It depends on the DOS. In this particular instance, B is loaded with zero before determining whether it's a read or write, so the LRL is fixed at 256. Paul: And if the file had been created with a different LRL, like a word-processing file with an LRL of one, what would happen?

**Vernon:** It would open up the file with an LRL of 256 with any DOS except MULTIDOS. (Vernon laughs here.)

Paul: MULTIDOS would open the file with a length of one?

Vernon: Yes.

Paul: And with other DOSes, what would be the result of trying to read the file after opening it with a wrong LRL? Vernon: All the other DOSes, I think, regardless of what the directory entry says the LRL of a file is, will open up the file with the LRL indicated by the B register.

**Paul:** What would the result of that be? Would you get an error and jump to the...

Vernon: No! You would just read it in as 256 bytes.

Paul: So essentially, once it's loaded into memory, it's all the same anyway—it doesn't matter.

Vernon: Right. If you followed this routine with NEWDOS80 and opened a file that had an LRL of one, it would read it in as LRL 256. The pattern on the disk isn't affected by the LRL.

Paul: So everything would come out okay with any DOS?

Vernon: Right. This subroutine is very short, not even one page.

Paul: What is it, about 200 bytes? **Vernon:** Let's see. If you assemble it at 5200H, it will go to 5284, inclusive-

132 bytes. ■

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n an analysis of variance (ANOVA), you have two or more groups of data. The hypothesis you're testing boils down to the question, "Are any groups different from the others?" The hypothesis that all groups are the same is called the "null hypothesis." The hypothesis that at least one pair of groups differ from each other is called the "alternative hypothesis." But what do we mean by different?

In the ANOVA test, you compare the means of the groups. However, just because the means of the groups are not the same does not indicate that the groups are actually different. If you sampled height in New York and in Oregon, and the mean heights were 5' 9" and 5' 10", are the heights in the two states actually different or was the sample of people chosen so small that the difference can be explained by the chance occurrence of just talking to tall people in Oregon (the only ones with their heads above water), and just talking to short people in New York (the ones below the smog)?

So you see the problem of inferential statistics. You must infer a conclusion about the means of the total population of New York and Oregon on the basis of a small sample of people in each state. A small sample can be biased for a number of reasons, including random chance. In fact, it would be very surprising if you got exactly equal numbers for the mean height even if the means were actually identical!

The job of inferential statistics is to tell us whether the groups are different, and also to give us a measure of the probability that our assessment is wrong.

ANOVA does this by making two independent measures of variability. The first is the average variability within each group, which we will call "within" variability. The second is the variability among the means of each group—the "between" variability. If the groups are the same (which implies that they originate from the same population) then these two measures of variability ought to be the same. If they are not the same, then "between" ought to be bigger than "within."

That is the essence of ANOVA and the F-ratio test used to determine how different the means are. The F-ratio test uses a measure of variability called



### More about regression

"sum of squares" for both "within" and "between." This sum of squares is then normalized by dividing by the degrees of freedom for each, leaving the "mean square." The F ratio is the mean squares for "between" divided by the mean squares for "within." The task of determining whether the groups are different then reduces to the problem of testing to see if the F ratio is different than 1.

"Degrees of freedom is the number of items free to vary minus the restrictions placed on the data."

Degrees of freedom is the number of items free to vary minus the restrictions placed on the data. The more subjects you have, the greater the degrees of freedom. You might find it easier to think intuitively—the more subjects you have, the less the probability that your sample is biased by random chance, so the more reliable your conclusions drawn from your analysis will be. There are tables of F versus degrees of freedom "within" versus degrees of free-

dom "between." In our program, we will use a rational polynomial approximation to the distribution of the F ratio (see my February 1982 column for a description of approximation theory). The table and the approximation give you the probability that the F value you observed from the sample means was due to random chance variation and not to any real difference among the groups.

#### F Ratio

What about the job of computing this F ratio? Geoffrey Keppel has written an excellent notation for ANOVA computational formulae in his book Design and Analysis published by Prentice-Hall. Let's consider the notation and kind of data applicable for a while.

By "score," I mean that you make a measurement on a number of subjects. For example, you might want to relate score on an IQ test to drinking coffee. In this case, you might have three groups of subjects: Group A would drink no coffee, group B would drink one cup one hour before taking the test, and group C would drink five cups within 30 minutes before the test. The results of the experiment—the F test denoting difference among the groupswould indicate whether coffee affects scores on IQ tests.

Note, by the way, the implicit assumptions of the test. You are assuming the groups' IQs are the same at the start of the experiment-you could ensure this by randomly assigning people to the groups. If the number of subjects is great enough, the probability of random bias to one or more groups decreases. That is, with enough subjects, the number of high, medium, and low-IQ people should be about the same.

You are also assuming that the only difference among the groups is the amount of coffee drunk. Any other difference (like if some of the people did not have time to eat breakfast) would muddy your conclusions.

Let's let "a" be the number of groups and "s" be the number of subjects. We will assume that all the groups have the same number of subjects. The total number of subjects in the experiment is a\*s. We will use AS to denote a single score, and A to denote a group sum. To make the formulae less intimidating, we will make the following definitions:

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```
10 DEFINT I-N
20 CLS:PRINT"
              ***** ANALYSIS OF VARIANCE PROGRAM ******
30 PRINT"
                         WRITTEN BY"
40 PRINT"
                    BRUCE POWEL DOUGLASS'
                        1005 WEST MAIN
50 PRINT"
60 PRINT"
                   VERMILLION, SD
                                     57069"
70 PRINT
80 INPUT"ENTER THE NUMBER OF GROUPS"; NG
90 INPUT"ENTER THE NUMBER OF SCORES PER GROUP"; NS
100 DIM X(NG, NS)
110 REM
         ***** DATA INPUT
120 FOR I=1 TO NG
130
      PRINT"GROUP #"; I
140
      FOR J=1 TO NS:PRINT"ENTER SCORE #";J;" : ";
150
      INPUT X(I,J)
160 NEXT J,I
          *****
170 REM
                   RUN ANALYSIS
180 DIM SM(NG), SQ(NG)
190 FOR I=1 TO NG
200
      FOR J=1 TO NS
        SM(I) = SM(I) + X(I,J)
220
        SQ(I) = SQ(I) + X(I,J)[2
230
        T=T+X(I,J)
240
      NEXT J
250
      AS=AS+SQ(I):A=A+SM(I)[2
255 NEXT I:A=A/NS
260 TL=T[2/NG/NS
270 SB=A-TL:SW=AS-A:ST=AS-TL
280 DB=NG-1:DW=NG*(NS-1):DT=NG*NS-1
290 MB=SB/DB:MW=SW/DW
300 F=MB/MW
1000 ZF=F:D1=DB:D2=DW:GOSUB 1040:P1=P
1010 REM ** F RATIO PRINT FORMAT
1020 CLS:PRINT" SOURCE"," SS'
                               SS"," DF","F RATIO"
1030 FORI=1TO127:SET(I,4):NEXTI:PRINT:PRINT
1031 PRINT"BETWEEN", SB, DB, F
1032 PRINT"WITHIN", SW, DW
1033 PRINT"TOTAL", ST, DT
1034 PRINT
1035 PRINT"P(F) = "; P
1036 END
1040 'P(F) COMPUTATION
1050 IF ZF<1 THEN P=0:RETURN
1060 A=2/9/D1:B=2/9/D2
1070 P=ABS((1-B)*ZF[(1/3)-1+A)/SQR(B*ZF[(2/3)+A)
1080 IF D2<4 THEN P=P*(1+.08*P[4/D2[3)
1090 P=.5/(1+P*(.196854+P*(.115194+P*(.000344+P*.019527))))[4
1100 P=1-INT(P*4000+.5)/4000
```

Program Listing 1. ANOVA

```
 \{T\} = T^2/(a^*s)   \{A\} = \Sigma A^2/s : A \text{ is the sum of each group here } \{AS\} = \Sigma (AS)^2
```

The sum of squares for the total  $SST = {AS} - {T}$ ; the sum of squares between the groups,  $SSB = \{A\} - \{T\}$ ; and the sum of squares within is defined to be  $SSW = \{AS\} - \{A\}$ . By the way, you can check your arithmetic by the relation SST = SSB + SSW. Since the degrees of freedom is the number of observations minus the number of restrictions imposed by computation, the degrees of freedom for the "between" sum of squares is (a-1); we estimate the mean of the overall experiment (thereby imposing one restriction) and we have "a" groups. The degrees of freedom for the "within" sum of squares is computed easily as well. We have "s" subjects in each group, and we use these to calculate the mean.

Therefore, each group contributes (s-1) degrees of freedom. Since there are "a" groups, we have  $a^*(s-1)$  for the "within" degrees of freedom. The degrees of freedom for the total sum of squares is  $a^*s$  (the number of samples) minus the restrictions placed on the data by our computing the mean, or  $a^*s-1$ .

We divide the sum of squares by their respective degrees of freedom to get the mean squares: MSB = SSB/DFB, and MSW = SSW/DFW. The F ratio is defined to be the ratio F = MSB/MSW, and it has (a-1) and a\*(s-1) degrees of freedom. We are now ready to write the program.

The ANOVA program (see Listing 1) shows the simplicity of the method without the extra clutter of saving the data to disk, or editing the data files. When you use it, you will be asked for the number of groups and the number of scores in each (your groups must

have equal numbers of scores). Then you type in the data, one group at a time. The program thinks a little bit (as per our discussion above) and grinds out the data.

#### Regression

Analysis of variance is a special case of regression. In regression, you have paired or matched observations in two or more groups. The object is to find a line that best fits the relationship among the data points.

For example, there is a relationship between height and weight. The taller people are, the more they weigh. But that is not all there is to the subjectwhat about body fat and occupation? The amount of variability in one variable that is explained by another is called the correlation between them. This correlation is the relationship between the variables. If there is a one-toone correspondence between the variables, then the correlation equals one; if there is no relationship (that is, the variables are totally independent), then the correlation equals zero; finally, if the relationship is corresponding and inverse, then the correlation is minus one. (This type is called a product-moment correlation.)

"The amount of variability in one variable that is explained by another is called the correlation between them."

Regression uses the correlation to find the best-fitting line showing the relationship between the variables—"best" in terms of least-squares best fit. If  $Y_i$  is the actual value of data point i, and  $Y_i$  is the value predicted by the regression line, then the least-squares best fit finds the minimum value for the function  $(Y_i - Y_i)^2$ . The square of the difference between the real values and the predicted values is then a minimum. This assumes that the relationship between the variables is a straight line. The less true that assumption is, the worse the fit of the line will be to the real data.

The basic equation for a simple bivariate regression is Y' = aX + b. The slope of the line is "a," and "b" is the intercept, or the place where the line crosses the Y axis on a graph. Let's let "r" be the correlation between X and Y. Then the equation for r is:

 $r = \Sigma xy/SQR(\Sigma x^2\Sigma y^2)$ 

where

 $\Sigma x^2 = \Sigma X^2 - (\Sigma X)^2/N$  (deviation sum of squares)  $\Sigma xy = \Sigma XY - (\Sigma X)(\Sigma Y)/N$  (sum of cross products)

N = number of points X = raw data point for variable X Y = raw data point for variable Y $XY = \text{product of } X_i \text{ and } Y_i$ 

The value  $r^2$  is called the common variance. It is the percentage of the total variability in Y that is explained by the presence of variable X. Note that  $1-r^2$  is the variability that X and Y do not have in common; it is called the residual variance, and stands for the variance in Y that is not explained by the presence of variable X.

In our regression equation, the line parameters "a" and "b" can be defined by:

 $b = \sum xy / \sum x^2$  $a = Y_m - bX_m$ 

where

 $Y_m$  = the mean of Y  $X_m$  = the mean of X

An inference is usually associated with some test to give a measure of how likely it is that we are wrong in drawing that inference. A common one used for regression is the F test, defined above. The F ratio defined for the bivariate regression is:

 $F = r^{2} N/(1 - r^2)$ 

So far, we have only discussed the case in which there is a variable to be predicted (the dependent variable Y) and a single predictor variable (also known as the independent variable X). The general case is called multivariate regression. In this case, there are many predictor variables and a single predict-

#### Program Listing 2. Regress

```
10 DEFINT I-N
15 CLS
30 PRINT"** WRITTEN BY BRUCE POWEL DOUGLASS 1981 **"
180 REM *****
                  INPUT ROUTINE
190 INPUT"HOW MANY INDEPENDENT VARIABLES"; M: INPUT"NUMBER OF SCOR
ES PER GROUP"; N
200 DIM X(M,N)
210 FOR K=1 TO N
220 PRINT, "Y("K") = X 0 ("K")"
230 FOR J=0 TO M:PRINT "INPUT X"J"("K") = ";:INPUT X(J,K):NEXT J,K
240 DIM P(M),SX(M),S(M,M),R(M,M),T(2*M,M),E(M),B(M),SB(M),G(M),H
(M), Z(M+1,M+1), D(M), C(M) 'RUNTIME!
250 FOR K=1 TO N:FOR J=0 TO M
260 P(J) = P(J) + X(J,K) : NEXTJ
270 FOR L=0 TO M:FOR I=0 TO M
280 S(I,L)=S(I,L)+X(I,K)*X(L,K): 'MATRIX FOR SUM CROSS PRODUCTS
290 NEXT I,L,K
300 FOR I=0 TO M:FOR J=0 TO M
310 S(I,J) = S(I,J) - P(I) * P(J) / N
320 NEXTJ,I
330 REM *****
                  BASIC STATISTICS GENERATION
340 FOR J=0 TO M:P(J)=P(J)/N:SX(J)=SQR(S(J,J)/(N-1))
350 'P=MEAN, SX=ST.DEV., NOTE THAT Y=X(0)
360 NEXT J
370 REM *****
                  CALCULATE R (CORRELATION) MATRIX
380 FOR J=0 TO M:FOR I=0 TO M
390 R(I,J) = (S(I,J))/SQR(S(I,I)*S(J,J))
400 NEXT I, J: IF M=1 THEN GOTO 460
410 FOR J=1 TO M:FOR I=0 TO M
420 Z(I,J)=R(I,J):NEXT I,J:NQ=M
430 GOSUB1550: INVERT THE CORRELATION MATRIX & PUT IT INTO Z()
440 FOR J=1 TO M: E(J) = Z(M1, J)
450 B(J) = (Z(M1,J)*SX(M1))/SX(J):NEXTJ
460 AR=P(0):IF M=1 THEN B(1)=S(1,0)/S(1,1):AR=AR-B(1)*P(1):GOTO
480
470 FORI=1TOM: AR=AR-B(I) *P(I): NEXTI 'AR=INTERCEPT
480 REM ****** R SQUARED =SS(REG)/SS(T)
490 FOR I=1 TO M:RG=RG+B(I)*(S(0,I)): 'RG=SS(REG),S(M1,M1)=SS(T)
500 NEXT I:RS=RG/S(0,0):IF M=1 THEN RS=R(1,0)[2: MULTIPLE VARIA
NCE
510 RM=SQR(RS): MR=MULTI CORRELATION
520 IF RS>=1 THEN SY=0 ELSE SY=SX(0)*SQR(1-RS):C1=1.96*SY:C2=2.6
1*SY
530 IF RS<>0 THEN F=RS*(N-M-1)/((1-RS)*M) ELSE F=0: DF(REG)=M,D
F(RES) = N-M-1
540 ZF=F:D1=M:D2=N-M-1:GOSUB 1780:P1=P
550 CLS: ****** PRINT BASIC STATS
560 FOR J=0 TO M:FOR I=0 TO M:PRINT USING"#.####";R(I,J);:PRINT"
    ;: NEXTI: PRINT: NEXTJ: PRINT
570 PRINT@832, "ABOVE IS THE CORRELATION MATRIX WITH X1 THROUGH X
NOTE THAT Y IS AT THE Ø POSITION IN ROWS AND COLUMNS"
580 INPUT"TO CONTINUE PRESS 'ENTER'"; Z
590 CLS:PRINT"SOURCE", "MEAN", "ST. DEV.", "RY.X"
600 FORI=1T0127:SET(I,4):NEXTI:PRINT:PRINT
610 PRINT"Y",P(0),SX(0),RM
620 FOR I=1 TO M:PRINT"X("I")",P(I),SX(I),R(0,I)
630 NEXT I:PRINT:PRINT:PRINT"NOTE THAT THE RY.X FOR Y IS THE MUL
TIPLE CORRELATION": PRINT"THE VARIANCE ACCOUNTED FOR BY THE REGRE
SSION IS";RS
640 PRINT"THE VARIANCE NOT ACCOUNTED FOR IS";1-RS
650 PRINT: INPUT"TO CONTINUE, PRESS 'ENTER'"; Z
660 GOSUB 1500
670 PRINT"REGRESSION",RS,M,F
680 PRINT"RESIDUAL",1-RS,N-M-1,"P(F)=";P1:PRINT
690 PRINT"THE REGRESSION EQUATION IS":PRINT"Y'=";:FOR I=1 TO M:P
RINT B(I)"X("I") + ";:NEXT I:PRINT AR
1380 REM ****** ROUTINE FOR ROW SWITCH
1390 FOR K=0 TO M
1410 W=E(K,J):E(K,J)=E(K,J+1):E(K,J+1)=W
1420 NEXT K: RETURN
1470 CLS: PRINT"SINGULAR MATRIX ENCOUNTERED.
NO UNIQUE SOLUTION EXISTS"
1490 END
1500 REM ** F RATIO PRINT FORMAT
1510 CLS:PRINT"SOURCE"," SS"," DF","F RATIO"
1520 FORI=1T0127:SET(I,4):NEXTI:PRINT:PRINT:RETURN
1530 END
1540 REM THIS IS THE ROW REDUCTION SUBROUTINE
```

Listing 2 continues

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```
Listing 2 continued
   1550 REM ROW REDUCTION ROUTINE
   1560 FOR I=0 TO NQ: Z(I, NQ+1) = Z(I, 0): Z(NQ+1, I) = Z(0, I): NEXT
   1570 FOR J=1 TO NQ: IF Z(J, J) =0 THEN GOSUB 1380
   1580 A=Z(J,J):FOR I=1 TO NO+1
   1590 Z(I,J) = Z(I,J)/A: NEXT I
   1600 IF J=NO THEN 1670
   1610 FOR T=J+1 TO NO
   1620 IF Z(J,T)=0 THEN 1660
   1630 B=Z(J,T):FOR I=1 TO NO+1
   1640 \ Z(I,T) = Z(I,T) - Z(I,J) *B
   1650 NEXT I
   1660 NEXT T.J
   1670 FOR J=NQ TO 2 STEP-1:FOR T=1 TO J-1:B=Z(J,T)
   1680 FOR I=NQ+1 TO J STEP-1
   1690 Z(I,T) = Z(I,T) - Z(I,J) *B
   1700 NEXT I,T,J
   1710 FOR I=0 TO NQ: Z(I,0) = Z(I,NQ+1): Z(0,I) = Z(NQ+1,I): NEXT
   1720 RETURN
   1780 'P(F) COMPUTATION
   1790 IF ZF<1 THEN P=0:RETURN
   1800 A=2/9/D1:B=2/9/D2
   1810 P=ABS((1-B)*ZF[(1/3)-1+A)/SQR(B*ZF[(2/3)+A)
   1820 IF D2<4 THEN P=P*(1+.08*P[4/D2[3)
   1830 P=.5/(1+P*(.196854+P*(.115194+P*(.000344+P*.019527))))[4
   1840 P=1-INT(P*4000+.5)/4000
```

ed variable. For example, weight may be predicted by height, fat percentage. and activity level. Weight would be the predicted variable, and the others would be used in predicting a weight for a given height, fat percentage, and activity level. The general regression equation may be written:

$$Y' = a_1 X_1 + a_2 X_2 + a_3 X_3 + \dots + b$$
 or  $Y' = \Sigma A_i X_i$  with an  $F$  ratio

$$F = (P^2/k)/((1-R^2)/(N-k-1))$$

#### where

R = multiple correlation coefficient

N =the number of scores

K = the number of independent variables

The large R, the multiple correlation coefficient, is different from the small r. Each small r, or first-order correlation, stands for the covariability between X<sub>i</sub> and Y. But what if the correlation between  $X_i$  and  $X_i$  ( $i \neq j$ , of course) is nonzero? Then some of the same relationship explained by  $X_i$  is shared by  $X_i$ ; they explain the same portion of the variability in Y. So you cannot just add up the variances. If the correlations among the independent variables are all zero, then  $R^2 = r_1^2 + r_2^2 + r_3^3 + \dots$  If the correlations are nonzero, this will overestimate the multiple correlation. After all, in a multivariate regression we are interested in the total predictability of Y by all the Xs together, right?

While I don't want to derive any of this, a straightforward computational method for obtaining the multiple correlation coefficient and the b-weights

for the regression equation is presented by Guttman ("A New Approach to Factor Analysis," Mathematical Thinking in the Social Sciences, 1954, Free Press).

First, calculate all the first-order correlations among the Xs and Y (e.g., X1 and  $X_4$ ,  $X_3$  and  $Y_4$ , and so on). Put these in a matrix called RG. Invert the matrix. If r<sub>w</sub> indicates the cell containing Y versusY in the inverted matrix RG, then  $R^2 = 1 - 1/ryy$ . And the b weights are defined to be:

 $Bi = -r^{yi}/r^{yy} \cdot S_y/S_i$ 

#### where

 $S_v = \text{standard deviation of } Y$  $S_i = \text{standard deviation of } X_i$ 

Although this probably seems a little mysterious, it works and is easy to program. You must know how to invert a matrix, but that is the only programming problem of any difficulty.

The program Regress (see Listing 2) does all this. You input the number of scores and variables, and the program computes the regression equation and the multiple-correlation coefficient. Like ANOVA, Regress is a bare-bones program; it lacks the niceties of data I/O, data editing, and a number of other statistical measures often given with the regression statistics.

I'm sure many of you will find the programs Regress and ANOVA sufficient for your needs, particularly if you add some simple data editing and file I/O routines.



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#### RELOAD 80

Good things come to those who wait, especially at Christmas. The first Color Load 80 cassette is out this month, covering the major Color Computer programs from 1982. It sells for \$14.97 and should warm any Color Computer owner's heart on Christmas morning.

Color Load 80 cassettes will be available every three months starting in March 1983. These 15-minute cassettes will pack a lot of material at 1500 Baud, and sell for only \$9.97. A subscription plan will be announced in early 1983.

#### **Using Color Load 80**

The documentation for each Color Load 80 includes a list of the programs and a short description of how to use them. My phone number and address at 80 Micro are supplied in case of technical problems. The magazine, however, is the source of documentation for the individual programs. If you don't read the article, you won't be able to use Color Load 80.

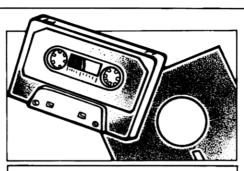
Most programs on Color Load 80 are intended for a minimum system of 16K and Extended Color Basic, but a few may require only 4K Color Basic, and others 32K with disk drives. If the Key Box in the article doesn't list your system, then the program will not run correctly.

Model I and III Load 80s include Assembly-language files instead of machine-language. As of yet, no Editor/Assembler has become a de facto standard for the Color Computer, so Color Load 80 tapes will include machine-language files ready to load and execute using CLOADM.

#### New Disk Operating System for MOD I/III

Starting with December 1982, Model I and III Load-80 disks will be supplied on TinyDOS (TDOS), the DOSPLUS kernel. This operating system has been stripped to make enough room for the programs.

Model I users can now use the Load 80 disk in Drive 0. To use the Basic files, simply enter Disk Basic and run the program of your choice. Assembly-language files will still require and Editor/Assembler. To make a backup, use the backup utility supplied on TDOS. If you have installed the LNDOUBLER 5/8 board in your expansion interface you will have to use



### Load 80 goes color

another operating system to backup, the disk.

Load 80 disks are double-sided to allow more program room. Each side contains TDOS and can be accessed by simply flipping the disk.

Model III owners must use the TRSDOS Convert utility before using the Load 80 disk.

- 1 Make a backup of your TRSDOS disk and place it in Drive 0.
- 2 Type Purge, and then your TRSDOS disk's master password.
- 3 Answer Y for each file. It will be purged from the disk.
- 4 Insert the Load 80 disk in Drive 1. Type Convert.
- 5 Answer 1 for Source, 0 for Destination. The Load 80 programs will be copied onto the TRSDOS disk.
- 6 Flip the Load 80 disk over and do steps 4-5.

The Load 80 programs are ready for use on TRSDOS.

#### **Anniversary Load 80**

Model I and III tapes and disks are available for the Special Anniversary 80

Month	Page	Article	Program	Туре
Feb.	202	Colorful Titrations	TITRATE	Education
Mar.	106	Subchaser	SUBCHASE	Game
	142	Is a Rose in Color Still a Rose?	ARTIST	Game
	142	Is a Rose in Color Still a Rose?	MAZE	Game
	142	Is a Rose in Color Still a Rose?	3-D	Game
	212	COLORMON	COLORMON	Utility
Aug.	94	The Colorful Computer (Part I)	THECOCO1*	Graphics
	188	Color Maze	MAZE	Game
	202	Four in One Plus Another	BRICKOUT	Game
	202	Four in One Plus Another	POINDEXTER	Game
	202	Four in One Plus Another	MATHTALK	Game
	202	Four in One Plus Another	PIXPRINT	Utility
	202	Four in One Plus Another	TANK-GUN	Game
	260	Space Duel	SPCDUEL	Game
	264	Square Game	SQRGAME	Game
	268	Color Breakaway	BRKAWAY	Game
Sep.	140	Basic Word Processing	WORDPROC	Application
	230	Joystick Paintbrush	PAINTBRU	Graphics
	238	Conversion	CONVRSNS*	Game
Oct.	168	Income Tax Estimator	TAXCALC	Application
Nov.	164	More Color Conversions	SUBDSTRY	Game
	164	More Color Conversions	LLANDER	Game
	164	More Color Conversions	MISSILES	Game
	213	Color Assembler	ASSEMBLR	Utility
	272	Show the Score	SHOWSCOR	Utility
	304	Test Patterns	TVTEST	Application
	308	Music Marvel	MUSIC	Application
Dec.	388	Picture-Editor	PIC-ED	Graphics

\* All listings in the article are combined into one program. Each is accessed from a menu.

1982 Color Computer Load 80 Directory

## WAYNE GREEN BOOKS

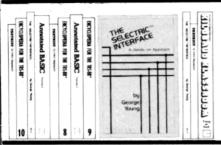
#### KILOBAUD KLASSROOM

by George Young and Peter Stark

Makes learning electronics fun and easy. First published as a series in Kilobaud Microcomputing, the book combines the learning of essential theory with practical, hands-on experience. The course begins with basic electronic projects and culminates in the construction of your own programmable microcomputer. The direct instructional methods of authors Young & Stark make KILOBAUD KLASSROOM a simple way for you to acquire a solid background in digital electronics.

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An index to Load 80 programs and

Reload 80 columns for 1982 will be published int he January 1983 issue. Complete lists for 1981 and 1982 will be published in the Anniversary Issue.

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December Load 80 Directory

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#### Compiler

The "LC" Compiler provides a substantial subset of the C programming language with: o Integer subset of C; has

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access to floating point ROM routines via functions o All statements supported

except: SWITCH-CASE, GOTO, TYPEDEF, STRUCT, UNION. o All operators except "->",

".", SIZEOF, (TYPENAME).

o Standard I/O redirection

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o Assemble conditional code with IF, IFLT, IFEQ, IFGT, IFDEF, IFNDEF, IFREF to 16 levels with IF-ELSE-ENDIF.

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#### CALENDAR

#### December

- 6-7 Future Computing Inc., Richardson, TX. Home Computer Market Forum Loews Antole, Dallas, TX.
- 6-8 IEEE Computer Society, Silver Spring, MD. Winter Simulation Conference Holiday Inn at the Embarcadero, San Diego, CA.
- 6-8 IEEE Computer Society, Silver Spring, MD. VLSI & Microcomputers: Today and Tomorrow (TENCON '82) Hong Kong.
- 6-10 IEEE Computer Society, Silver Spring, MD. **Tutorial Week West '82** San Diego, CA.
- 7-8 The Yankee Group, Boston, MA. Strategy/Counterstrategy: The Network as a Corporate Resource New York, NY.
- 7-9 IEEE Computer Society, Silver Spring, MD. 1982 Real Time Systems Symposium Los Angeles, CA.
- 7-9 Technical Education Research Centers, Cambridge, MA. Microcomputers in Education St. Louis, MO.
- 10 IEEE Computer Society, Silver Spring, MD. Computer Networking Gaithersburg, MD.
- 9-12 National Computer Shows, Chestnut Hill, MA. The Second Annual Southeast Computer Show and Office Equipment Exposition Atlanta Civic Center.
- 7-8 The Yankee Group, Boston, MA. Strategy/Counterstrategy: The Network as a Corporate Resource Palo Alto, CA.

13-15 Technical Education Research Centers, Cambridge, MA. Microcomputers in Education Boulder, CO.

#### January

- 17-18 EMA Management Associates Inc., Richmond, VA. Using Small Computers in the Professional Design Firm Hyatt Kuilima Northshore, Kahuku, HI.
- 17-20 IEEE Computer Society, Silver Spring, MD. Optical Storage of Digital Data Lake Tahoe, CA.
- 18-20 Technical Education Research Centers, Cambridge, MA. Microcomputers in Education Tallahassee, FL.
- 31-2 Future Computing Inc., Richardson, TX. UCSD p-system Industry Forum Loews Anatole, Dallas, TX.

#### **February**

7-9 Technical Education Research Centers, Cambridge, MA.

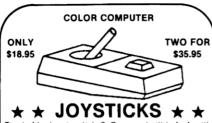
- Microcomputers in Education Washington, DC.
- 14-17 IEEE Computer Society, Silver Spring, MD. Computer Science Conference Orlando, FL.
- 16-18 IEEE Computer Society, Silver Spring, MD. International Solid State Circuits Conference New York, NY.
- 17-19 Technical Education Research Centers, Cambridge, MA. Microcomputers in Education New York, NY.
- 21-23 American Federation of Information Processing Societies Inc., Philadelphia, PA. Office Automation Conference Philadelphia Civic Center.
- 23-25 Future Computing Inc., Richardson, TX. Personal Computer Retail Forum Loews Anatole, Dallas, TX.
- 25-27 Computer Expo 83 Orlando, FL.

## Coming Next Month

To celebrate the new year, our January issue will include an incredible program—Creator, by Bruce Tonkin (see Proof Notes, p. 16 for more info).

Also featured will be articles telling you how to market your own software. Topics will include deciding on a publisher, copyrighting how-to, and documentation do's and don'ts.

Of course, we will continue Philip Van Praag's "Hardware Hacker" series and Margaret Grothman's "APL Primer," and feature several timely reviews and Color Computer articles.



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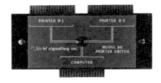
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# **Project Management System**

The Demi-Plan Project Management System is now available for Model I and III computers with 48K of memory, one or more disk drives, and a printer.

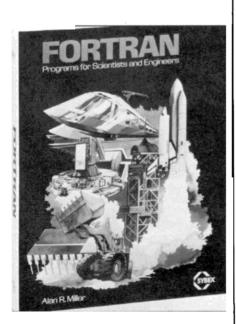
This program allows the user to define and maintain a file of project tasks and resources. This information is used to print various forms of Gantt charts, resource histograms, and task/resource cross-reference printouts. The system determines the critical path of a project and allows the project manager to introduce "what if" data to show the effect of date and resource changes on completion date.

The Demi-Plan disk sells for \$49.95, with documentation alone available for \$5. For more information, contact Demi-Software, 6 Lee Road, Medfield, MA 02052, (617) 359-4502.

Reader Service -580

# Fortran Programs for Scientists and Engineers

Over 60 of the most frequently used scientific algorithms, along with their program implementations written in Fortran, are presented in Fortran Programs for Scientists and Engineers. The material covered in this volume, including curve fitting, vector and matrix arithmetic, numerical integration, random number operations, and statistical analysis, will be of practical use to any scientist or engineer, and the



Fortran Programs for Scientists and Engineers

programs can be readily adapted to most applications.

Each chapter contains exercises designed to test and extend reader comprehension of the material presented. For the first-time Fortran user (and the veteran who needs a quick reference), a summary of the syntax, standard functions, and reserved words of Fortran is included in the appendices.

Priced at \$15.95, this book is available from Sybex, 2344 Sixth St., Berkeley, CA 94710.

Reader Service - 585

# **Sell Your Programs**

Vendor-One is a Model I utility for program authors that permits your software to be sold on a custom-formatted disk that both single- and multiple-drive customers can use. The package includes a licensing agreement for unlimited distribution copies of your disk.

A Model III version will be available soon. Vendor-One sells for \$30 from Applied 80 Softwares, 4316 Vermont Court, Virginia Beach, VA 23456.

Reader Service -574

# One-Megabyte Minifloppy Drive

The slimline minifloppy M4853 from Mitsubishi is a double-headed, 96-tpi, 51/4-inch standard drive. The unit has track-to-track access time of 3 ms, head load time of 50 ms, and a settling time of 15 ms.

The M4853 also includes a precision head load mechanism with all ferrite heads, a circular gimbal-type support for high data reliability and long media life, and an advanced direct-drive brushless motor that eliminates all concern for belt changes. Disk rotation starting time is 250 ms.

The drive's dimensions are 1.61 by 5.75 by 8 inches. Its price is \$450. For additional information, contact Inflo Inc., 244 Mill Road, Yaphank, NY 11980, (516) 924-9229.

Reader Service - 566

### **Very Micro Computers**

CompuGift Inc. (P.O. Box 1408, El Toro, CA 92630, (714) 768-8223) has introduced a line of desktop gift products in the shape of a 4½-by-4½-by-6-inch computer terminal. The Computer Caddy is a pen and pad holder,



CompuGift

while the Computer Planter and Computer Bank provide a place for flowers and coins.

The screen of each CompuGift forms a frame for your favorite picture. All items are individually gift boxed, and available in light grey, dark grey, yellow, and magenta high-quality plastic. Each is \$8.99 plus \$2 postage and handling.

CompuGift is the idea of a California systems analyst and his wife, a computer specialist. The company predicts first-year sales of \$100,000, saying, "Everybody is computer crazy nowadays; who wouldn't like a gift like this?"

Reader Service - 550

### **Z80 System Reference Card**

A new 16-page, \$4.95 card summarizes and captures the entire language of the Z80 microprocessor chip for easy reference.

The card provides clock periods and microseconds for every instruction. A formula on the front page lets you calculate your own timing, regardless of your machine's MHz. In addition, all instructions are completely listed in opcode sequence for PEEKing, and mnemonic sequence for POKEing. A condition code chart and hex-to-decimal chart make programming easier. The undocumented op-codes found on some chips are included, as are decimal equivalents for every instruction.

The Z80 System Reference Card is available from Nanos Systems Corp., P.O. Box 24344, Speedway, IN 46224.





# Dosplus II magic. For you and your business.

The TRS-80 model II was created to help you take care of your business. DOSPLUS II was created to help your TRS-80 help you and your business even more.

DOSPLUS II replaces your O.E.M. dos with an ultra-sophisticated operating system that is incredibly faster, more reliable and is totally compatible with all standard business oriented software designed for use with the model II. The result is a computer/operating system that far exceeds manufacturer's specs — with more potential and more capacity to be of service to you.

DOSPLUS II operating systems are available for either your floppy or hard disk drives. The hard drive operating system is compatible with Radio Shack, QuCeS, Corvus Micro Mainframe, VR Data and other popular hard drive sub-systems.

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DOSPLUS II DOSPLUS first in quality! First in the industry!





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# Farm Weather Center

Specialized software for deriving individual crop and field estimates of crop development and soil moisture balance is now available for the 48K Model III with one disk drive.

With simple rain gauge observations and daily readings of maximum/minimum temperature as input, the programs yield graphic displays of results along with summary reports and statistics through menu selections.

Prices start at \$125 for one crop (either corn, soybeans, or spring wheat), while all three are available for \$200. For more information, write Climate Assessment Technology Inc., 11550 Fuqua St., Suite 355, Houston, TX 77034.

Reader Service - 584

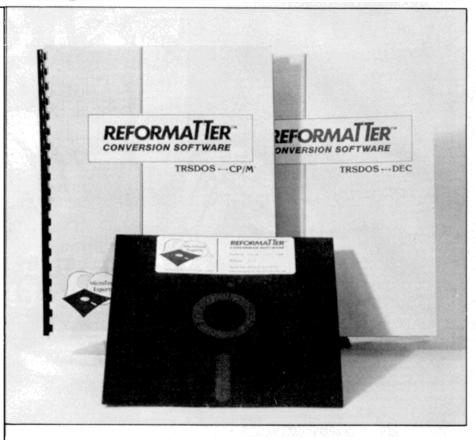
# **Port Expanders**

A series of software-controllable port expanders from Advanced Systems Concepts Inc. allow single-port units to interface with multiple peripherals or computers.

The port expanders are compatible with computers, printers, plotters, terminals, and modems that have an RS-232C or Centronics-compatible interface. The Model QS11 allows a single port to talk to one of four output devices. The Model MO11 allows four computers, modems, or terminals to share a common unit, such as a letterquality printer.

Each unit weighs two pounds and comes in a 13.5-by-7-by-2-inch enclosure. They use CMOS technology and consume negligible power. Each retails for \$450 from Advanced Systems Concepts Inc., P.O. Box Q, Altadena, CA 91001, (213) 684-5461.

Reader Service - 562



Reformatter

# **Bytewriter**

The Bytewriter is a letter-quality, daisy-wheel printer/typewriter. It features a built-in Centronics-compatible parallel interface. All you do is connect it to your computer.

The Bytewriter has 44 alphanumeric keys plus 12 function keys, a 12-character buffer memory, a switchable second keyboard with foreign grammar symbols, memory erase of the past 10 characters, a half-space key, and automatic repeat on any key. Character densities of 10, 12, or 15 cpi are switch selectable.

This product sells for \$795. For more information, contact Bytewriter, 125 Northview Road, Ithaca, NY 14850, (607) 272-1132.

Reader Service - 590

# DEC and CP/M Conversion Software

Model II users can now exchange data files and source programs with CP/M or DEC RT-11 systems using Reformatter conversion software from MicroTech Exports Inc.

TRSDOS to CP/M reads and writes single-density CP/M disks, and TRSDOS to DEC reads and writes single-density RT-11 disks. A third program, TRSDOS to IBM, is available exclusively from Tandy Corporation through Radio Shack stores.

Each version runs on a single-drive Model II and provides full facilities for file reorganization and directory maintenance on the target disk. In addition to bidirectional transfer of files between the two operating systems, the program provides complete file statistics for the target disk, and permits the user to delete or rename files, alter user numbers, and convert TRSDOS disks to the target disk.



ASCI Port Expander

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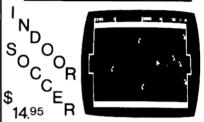
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Pel/Tek announces two great new machine language arcade games w/sound for TRS-80 MOD I or III, disc or tape



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324



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Priced at \$249 for each version, Reformatter software is available from MicroTech Exports Inc., 467 Hamilton Avenue, Palo Alto, CA 94301, (415) 324-9114.

Reader Service - 561

# Macro Assembler and Editor For Color Computer

Macro-80c is a macro assembler, screen-oriented editor, and machine-language monitor for the Color Computer disk system.

The assembler features local labels, conditional assembly, page headers, and symbol-table cross-reference listings. The full standard 6809 instruction set is supported, along with many additional pseudo-ops such as SET, ASK (for keyboard input during assembly), and even PEEK and POKE. There is a stack available for writing structured macros, and complete documentation on the assembler's support of such techniques as embedding machine language into Basic programs or writing programs that checksum themselves.

The text editor may be used on any type of text file, but is designed specifically for quick and easy editing of Assembly-language source files. It requires no line numbers, so you can use the arrow keys to position the cursor anywhere in the file. There are single-letter commands for insert, delete, change, move block, copy block, search, global change, and so on. An automatic repeat feature saves repetitive keystrokes.

A machine-language monitor is included, which allows display and modification of memory using a formatted hex display. Memory may be dumped to a printer or a text file. Breakpoints may be set, blocks of memory set or moved, and so forth.

Example programs on disk are included, as are 75 pages of documentation. Macro-80c requires a 16K or 32K Color Computer with disk drive; multiple drives are supported. Priced at \$99.95, it is available from The Micro Works, P.O. Box 1110, Del Mar, CA 92014, (714) 942-2400.

Reader Service -555

# **Finding Kindred Spirits**

The Personal Computer Owners Directory can help you find people with the same interests or computer who are



Touch-Tone Modem

willing to trade information. The Models I and III and the Color Computer are listed, as are popular micros from Apple, Atari, Commodore, IBM, and others.

The directory lists 59 different interests, ranging from adventure and aerospace to utilities and word processing. Others are physics, commercial applications, education, data-base management, games, law, income tax, robotics, and many more.

For a free, permanent listing in the directory, send your name, address, computer type, interests, and whether you are willing to trade information to Personal Computer Owners, Dept. 1F, P.O. Box 426, Feeding Hills, MA 01030. To receive the current issue and the next issue with your listing, send \$9.95 and the above information.

Reader Service - 557

# **Adventure Trilogy**

Colorquest, a division of the Softlaw Corporation, has introduced a new line of fantasy games featuring full color, machine-language 3-D graphics, and sound.

The Adventure Trilogy takes you to the World Under the Cimeeon Moon to engage in ritual battle with tooamoath and narthokes, then to Dazmor's Underworld of Doom to capture the Eye of Dazmor, and finally through the Ugrek Mountains to the Forsaken Gulch to restore the Eye to the Idol. Survivors are invited to try the sequel, Beyond the Cimeeon Moon, which involves a voyage to outer space.

The Adventure Trilogy and Beyond the Cimeeon Moon are available on disk for the Color Computer. Price is \$29.95 each from Colorquest, P.O. Box 19096, Minneapolis, MN 55419, (612) 827-4703.

Reader Service -576

### Touch-Tone Decoder Modem

The Touch-Tone Decoding Host Modem is a device for converting standard telephone Touch-Tones to ASCII equivalents. The modem has provision for a Bell 103 (300 baud) or Bell 202 (1,200 baud) data output response. An audio port for voice response is available as an option.

This product connects the direct-dial telephone network with any host computer capable of asynchronous communications via an RS-232 port.

The modem also features autoanswer circuitry. When called, it goes off-hook and awaits suitable input for two minutes. If no input is received, the modem automatically resets to onhook, awaiting the next call.

When one of the 16 valid Touch-Tone pairs is received, it is converted to ASCII and sent in a serial stream to the host. The outbound responding data, from the RS-232 port, is used to modulate a frequency shift keyer (FSK). This permits transmission over the telephone network to the calling terminal.

Communication with the host RS-232 is at 300, 600, or 1,200 baud (depending on the model selected), via a standard DB-25 connector. Since the same baud rate is used for incoming

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# **MODEL III** COMMUNICATIONS

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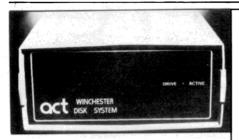
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Published prices reflect cash discount. All prices are subject to change without notice. TRS-80 and TRSDOS are trademarks of Tandy Corp. DISK III is a trademark of VR Data Corp. 8:30AM-7PM E.S.T. Mon.-Fri., Sat. 10AM-3PM CABLE "VRDATA" TELEX 845-124



ACT Winchester Drive

and outgoing data, no special split baud rate software is required.

Priced at \$500, the Decoding Host Modem is available from Micro-Peripheral Corp., Koll Business Center, 2643 151st Place N.E., Redmond, WA 98052, (206) 881-7544.

Reader Service -578

### **Down Under Disks**

The ACT Winchester Disk Drive, produced by the Australian Computer and Telecommunications division of Australian Protection Industries, New South Wales, offers five- and tenmegabyte storage capacity for Model II and III computers.

The hard-disk package includes a Winchester-type 5¼-inch drive with five megabytes of formatted mass storage and a microsequencing controller card with complete floppy-like interfacing. The controller end of the package has been designed to run a second 5½-inch hard disk, if desired.

Two Winchester hard-disk interfaces are also available: the TRS-80 Model II, designed to work with any Model II system and the ACT controller package, and the TRS-80 Model III for any 48K Model III system and the controller package. Both interfaces are fully software supported with a CP/M 2.2 operating system, and arrive fully assembled and tested for instant plug-in use.

Price and other information is available from the Office of the Australian Trade Commissioner, 636 Fifth Avenue, New York, NY 10111.

Reader Service - 582

### Disk Listmaker

Disk Listmaker is an upgraded version of Manhattan Software's popular 16K tape program. It can store 500 names or items plus five-digit codes in 32K, or 1,000 names and codes in 48K.

In addition to fast machine-language alphabetical sorting, the program features selection and display or printout of names in any full code, or names in any group of codes. Any name or code may be edited, and any entry deleted.

Reported uses of the original program have included school pupil tracking, real-estate listing information, record and book cataloging, and many others.

The Disk Listmaker is available for Models I and III for \$20 from Manhattan Software, P.O. Box 1063, Woodland Hills, CA 91365, (213) 704-8495.

Reader Service -588

# Consolidation System For VisiCalc Users

VIZ.A.CON for the Models I and III adds a third dimension to VisiCalc. You can combine multiple pages of VisiCalc data from a model for hierarchical consolidations (for example, department, division, company, and so on) or for summations over periods of time (for example, month, quarter, or year-to-date).

Typical uses are to combine weekly payroll data into monthly, quarterly, and yearly reports and to combine department budget data into division, region, and company-level reports.

A special system layout form helps you organize your consolidation systems. With the filled-in information, you can create a complete network during a question-and-answer session that allows you to define an unlimited number of interrelated consolidation processes. These definitions can then be stored for later use.

VIZ.A.CON gives you the ability to set up special formulas (such as ratios or percentages) that can be recalculated after a consolidation process. You can customize titles, row and column headings, footnotes, and so on for each report created. Reports can be automatically saved in standard ASCII form that can be used with a word processor.

Priced at \$89.95, the program is available from Abacus Associates, Suite 240, 6565 W. Loop South, Bellaire, TX 77401, (713) 666-8146.

Reader Service - 564

### **Advice For Small Businesses**

Understanding and Buying a Small Business Computer is a handbook of realistic, practical advice for small-business owners and managers inter-

ested in possible computerization. Written by consultant Susan Blumenthal, the \$8.95 volume ranges from "Introducing an Average Computer" to determining whether your business needs a computer in the first place.

In addition, the book provides general information on microcomputers, minicomputers, and their peripherals' performance, operating costs, and maintenance and repair requirements. Other chapters help you decipher computer sales pitches, avoid employee hostility, and evaluate computer consultants.

It is available from Howard W. Sams & Co. Inc., 4300 W. 62nd St., P.O. Box 7092, Indianapolis, IN 46206. (317) 298-5400.

Reader Service - 552

# **Computer Care Kit**

The RSI Computer Care Kit contains three useful products for maintaining a word processor and computer. The kit includes one eight-ounce bottle each of anti-static spray; printwheel cleaner for removing ink and carbon build-up on Wang, Diablo, and Qume print wheels; and one spray bottle of screen and terminal cleaner. Also supplied are five foam-covered cleaning swabs, five lint-free cloths, and a print-wheel cleaning case.

The kit is available for \$9.95 from Repair Service Inc., 4738 N. Ardmore, Milwaukee, WI 53211, (414) 963-0603.

Reader Service ~573

# **Name That Song**

Name That Song is a game in which the player must guess the first word of



Computer Care Kit

the title of a well-known song. The player chooses a hard clue (fewer notes) or easy clue (more notes) for each song, and then hears the notes that allow him to identify it. The player must contend with a timer as well. Hard clues are worth 15 points and easy clues are worth 10 points, up or down. Two hundred points win the game amid great fanfare and dancing notes.

The game comes on cassette in two versions: Name That Song I—Children's Songs, and Name That Song II—Popular Hits. Each contains 72 familiar songs appropriate to the version. They are for a 16K Color Computer with Extended Color Basic and sell for \$10 each.

For more information, contact Computer Island, 227 Hampton Green, Staten Island, NY 10312.

Reader Service - 568

# TRS-80 Communications Program

Term/Host is a self-contained communications program for cassette or disk-based Model I or III systems with 48K of memory. The same version runs on all configurations.

The program handles all types of files in binary or ASCII modes. It supports complete remote operation of the user's system. As a host you may run machine-language or Basic programs, or up/download files from any remote terminal or system.

This menu-driven program comes with a 27-page user's guide for \$34.95. For more information contact Freedom Financial Enterprises of Washington Inc., 3601 Carriage Drive, Raleigh, NC 27612, (919) 787-8082.

Reader Service - 567

# Block Graphic Character Generator

MX-Graphic is a machine-language custom printer driver for the Models I and III with either an Epson MX-70 or MX-80 with Graftrax-Plus.

MX-Graphic generates standard TRS-80 graphic characters using the printer's bit-image mode and prints them in printer power-up configuration at between 1 and 2 cps. Normal text printing is not affected and graphics and text can be mixed as desired.

The block-character generator can be switched in and out by software to allow other printer configurations and

use of the bit-image mode. NEWDOS-80 JKL and Model III screen-dump functions are supported.

The program is available for all standard tape and disk configurations. In addition, versions are provided for Model Is with a Memory Sidecar manufactured by Displayed Video. Memory overhead is less than 800 bytes and the program is self-protecting in Basic operation.

With documentation included, MX-Graphic sells for \$19.95 (U.S.) or \$24.95 (Canadian) plus \$2 postage and shipping. For more information, contact CMD Micro Computer Services Ltd., 10546-106 St., Edmonton, Alberta, Canada T5H 2X6, (403) 423-3919.

Reader Service - 570

# Computer Carnival

Computer Carnival by Richard Ramella contains 60 Level II Basic programs, written primarily for children but useful to beginners of all ages. It includes both games and educational programs, arranged in order of difficulty. Most of the programs are short, making them easy to enter. Some can be entered by an experienced keyboarder and then used by children too young to read.

Each chapter has an illustration by the author, a short description of the program and how to use it, and a program listing. The games range from favorites like keno and bingo to original games and simulations, as well as graphic games. The educational games include math, letter guessing, and word games; a program teaching states and capitals; and even a Morsecode tutor.

Computer Carnival costs \$16.97 at computer stores or directly from the publisher, Wayne Green Books, Peterborough, NH 03458. A package containing the book and the programs on cassette is available for \$24.97 and the cassette alone for \$9.97, although the book is required for documentation.

Reader Service - 556

# Expanded Disk Storage For Models I and III

A series of floppy-disk drives for both internal and external mounting, offering up to four megabytes of unformatted storage for the Model III and two megabytes for the Model I, is now available from Interface Inc.

For internal storage on the Model III, there are four drives available. These include a single-sided drive with 40 tracks and 250K of unformatted storage for \$215, a single-sided drive with 80 tracks and 500K for \$335, a double-sided drive with 40 tracks and 500K for \$335, and a double-sided drive with 80 tracks and one megabyte of unformatted storage for \$435. A



Interface Disk Drives

maximum of two drives can be installed internally.

There are also four drive types available for external storage with the Models I and III, including color-coordinated cabinet, power supply, and cable. These drives are single sided with 40 tracks and 250K for \$315, single sided with 80 tracks and 500K for \$435, double sided with 40 tracks and 500K for \$435, and double sided with 80 tracks and one megabyte of storage for \$535.

Cabinet colors include computer blue, standard off-white, lime green, dark green, bright orange, brilliant yellow, black, or chrome.

All drives are TRS-80 compatibility tested before shipment and have a 90-day warranty. For more information, contact Interface Inc., 7630 Alabama Ave., Unit 3, Canoga Park, CA 91304, (213) 341-7914.

Reader Service - 565

# Single-Entry Ledger System

The Single-Entry Ledger System provides a menu-driven, easy-to-use general-ledger package for a cash-basis accounting system. This product maintains its own data files and provides a variety of reports. The programs, written in Extended Basic, are available for the Model III and the Color Computer.

The system's data files can contain any number of accounts and transactions, limited only by the size of the storage medium. Files may be added, deleted, or edited at any time. Reports include accounts in numerical order, comparison of year-to-date values with previous year, transactions by account number, and many more.

Priced at \$95, the Ledger System is available from Universal Data Research Inc., 2457 Wehrle Drive, Buffalo, NY 14221, (716) 631-3011.

Reader Service - 551

### **Dual-Mode Joystick**

A new plug-in joystick for Color Computer games offers both traditional spring-center return and a faster, more versatile free-floating mode.

A linear potentiometer translates the movement of the gimbal to electrical impulses, providing more accurate cursor control and faster motion. External switches allow players to shift back and forth between modes as often as they like, while cursor centering tabs on top

of the unit permit fine tuning for precise response.

The joystick is available for \$64.95 from Kraft Systems Co., 450 W. California Ave., Vista, CA 92083, (714) 724-7146.

Reader Service - 586

### Faster Disk Thesaurus

Refware Thesaurus 2.0 is a faster and expanded synonym-finder that replaces the first Refware Thesaurus published in 1981.

Compared to the earlier program, Thesaurus 2.0's ZBasic 2.2 machine language and new index feature allow it to respond more than 10 times faster—on the Model III, only seven seconds from the time a user asks about a given word until the program supplies a group of synonyms or related words. Vocabulary has been expanded to 24,800 entries, providing nouns, adjectives, verbs, and adverbs for all types of writing.

Thesaurus 2.0 requires two disk drives and 48K of memory, and is available in three formats: a four-disk set for Model III, 40-track, double density; a five-disk set for Model I, 35-track, double density; and a nine-disk set for Model I, 35-track, single density. The price of each is \$89.95 plus \$3 for shipping.

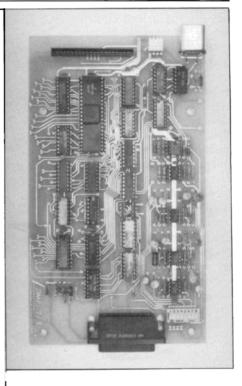
Through December 31, 1982, registered purchasers of Thesaurus 1.0 can exchange their disks for the new program for a \$30 service fee and \$3 shipping. For more information, contact Refware, David C. Whitney Associates Inc., P.O. Box 451, Chappaqua, NY 10514, (914) 238-8896.

Reader Service ~579

# Camp Management System

EZ-Camp is an integrated set of programs designed exclusively for camp management. The system was developed and field tested in conjunction with several camps using the Model II, and requires no programming knowledge or programmer support.

Besides maintaining complete camper information, the system can produce mailing lists, medical records, birthday or bunk lists, and many other reports required in camp management. Users can select standard reports, create their own, or use the system's word processor for personalized letters, application forms, newsletters, and the like. In addition to standard financial applica-



Computex Communications Board

tions, EZ-Camp also has capabilities aimed specifically at camps—like canteen supervision and cash advances for staff.

A demonstration disk can be obtained for \$50. For more information, contact EZR Micro Inc., 11 Conwell Drive, Maple Glen, PA 19002.

Reader Service - 560

# Model III Internal Communications Board

The M3CB1 communications board provides an RS-232C serial interface and a complete direct-connect modem all on one card slightly larger than the Radio Shack RS-232 interface. Totally software and hardware compatible with the Model III computer, the M3CB1 installs in less than 30 minutes in the same location as the Radio Shack RS-232 board.

The RS-232 supports asynchronous serial transmissions and conforms to the industry-standard EIA RS-232C interface. Baud rates from 50 to 19,200 baud are software selectable.

The 300-baud, full-duplex, directconnect modem uses FSK modulation techniques and supports both originate and answer modes of operation.

The assembly and installation manual provides step-by-step assembly instructions written for the first-time

# DOES STRING COMPRESSION HAVE YOU TIED UP IN KNOTS?

# LET TRASHMAN CLEAN UP THE MESS!

TRASHMAN is a machine language utility for the TRS-80 Models I and III. It was written by Glenn Tesler, the author of FASTER, and can reduce BASIC's string compression time by 95% (see table below).



#	SECONDS	PERCENT	
STRINGS	NORMAL	TRASHMAN	IMPROVEMENT
250	11.8	0.7	94
500	45.8	1.6	96.5
1000	179.6	3.5	98
2000	713.2	7.8	98.9

# WHAT'S STRING COMPRESSION?

When a BASIC program changes a string (words, names, descriptions), it moves it to a new place in memory, and leaves a hole in the old place. Eventually, all available memory gets used up and BASIC has to push the strings together to free up some space. This takes time. Lots of time. The computer stops running for seconds or minutes, and you may even think it's "crashed". The keyboard won't work, and until all the strings have been collected, you just have to sit and wait. Then things run for a while, until string compression is needed again.

If you're using your computer for business, that wastes your money. If you're using it personally, it wastes your time.

### WHAT'S THE SOLUTION?

As soon as you start using TRASHMAN, those delays almost disappear. It uses less than 600 bytes of memory, plus 2 bytes for each active string. It works with other machine language programs and with all major operating systems. It's easy to use, comes with complete instructions, and can be copied to your own disks.

### WHAT'S THE CATCH?

If a BASIC program uses only a few strings, very little time is wasted in string compression, and TRASHMAN won't be helpful. But, if hundreds of strings, including large string arrays, are used. TRASHMAN is just what you need.

Ask your software dealer for TRASHMAN, or order directly on our toll-free number. The price is just \$39.95 (plus sales tax in California).

(All timings done on TRS-80 Model I. Model III 15% faster, but pct. improvements identical. Listing of timing program available on request.)

# **AMAZING PROGRAM SPEEDS UP BASIC**



Your time is valuable, so why waste it on slow-running BASIC programs? PROSOFT's programs? PROSOFT's "FASTER" will analyze those programs while they run, then show you a simple change (usually one new line) that can re-

duce run-times by up to 50%.

Accounting systems, financial models, engineering and scientific programs all run faster; so do games. Large, complex programs improve the most, and "FASTER" is easy to use.

THIS ISN'T A COMPILER! Your BASIC programs remain readable and can be changed later on. While your programs run, "FASTER" counts how often each "variable" is used, then show the control of the countrick to the countrick to the countrick to the countrick to the countricks. you the correct sequence for these variables. Afterwards, the

computer finds them sooner, so your programs run faster.

Does it really work? Yes! Personal Computing said so in their May, 1981 issue (p. 116); we've received many letters from customers who've gotten 20-50% improvements; and we will make you this offer:

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Small (276 bytes), fast (processes 800 lines in under 3 seconds) utility removes blanks and remarks from your BASIC programs. Produces smaller, faster programs, and doesn't alter the original logic.

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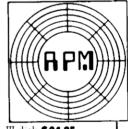
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RPM measures the rotational speed and variation of your disk drives, and reveals a common cause of unexplained errors. Simple one-key operation, runs under any DOS, interchangeable between Models I and III. Shows current and average speeds, plus fluctuation history. Recovers from severe errors. Documentation explains how to adjust drives. Use RPM monthly for best results. 32-48K Model I or III disk: \$24.95

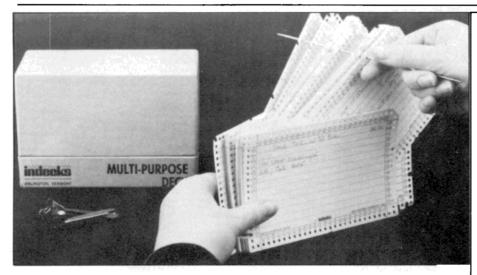


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Datasort

kit builder and includes installation pictures for each major step, theory of design, user information, and much more.

The M3CB1 is available as just the printed circuit board and manual (you supply components and assembly) for \$34.95, or as the complete kit for \$129.95. The RS-232 is also available assembled and tested for \$69.95, while the complete RS-232 and direct-connect modem comes partially assembled (you must insert one IC into a socket) for \$169.95. For more information, contact Computex, 17321 El Camino Real, Houston, TX 77058, (713) 488-8022.

Reader Service - 553

# Disk Menu and Directory

Most disk directories show only the filespecs and some seldom-needed other information. The Disk Menu and Directory by International Computer Products displays detailed descriptions of each program on the disk, as well as filespecs, date of creation, and more useful data.

The directory works without modification on Models I and III with TRSDOS, NEWDOS+, or other operating systems. Priced at \$29.95 plus \$1.50 shipping and handling, it is available from International Computer Products, 346 N. Western Ave., Los Angeles, CA 90004.

Reader Service - 577

# Reading Skills Lab

Reading Skills Lab is a new product for the Model III that offers a variety of exercises for improving basic reading skills, as well as short stories for reading practice. The complete lab contains 63 programs on six disks and three teacher's manuals with complete documentation.

The set was designed by a certified reading specialist, and the stories were written by professional children's authors. The core vocabulary lists for each grade level were taken from a list of words introduced in the most widely used basal reading series in schools today.

Exercises include word recognition, sight vocabulary, definitions, vocabulary in context, recall of detail, inference, main idea, sequence of events, and many other skills. Most programs include an optional printer module that allows preparation of worksheets for desk use. Each grade level also has at least one word game using the core vocabulary list to spark interest and reinforce skills.

The complete Reading Skills Lab, with exercises for students in grades 1-9, sells for \$1,000. The programs can also be ordered in smaller groupings: Lab A (grades 1-3), Lab B (grades 4-6), and Lab C (grades 7-9), priced at \$350 each. They can be ordered from NTS Software, 680 N. Arrowhead Ave., Rialto, CA 92376.

Reader Service - 571

# "Cardboard Computer"

Datasort, a "cardboard computer," allows you to store and retrieve information in any category combination you choose.

The system consists of a hand | Projects.

punch, a small rod (like a knitting needle), and file cards with numbered holes around all four edges. You develop your own category list indicating what you want the numbered holes to mean, then use your hand punch to clip away the tops of holes that apply to the information on each punchcard. To retrieve information, insert the rod at any category hole. When you lift the rod and shake the stack, cards notched for that category will fall off the rod.

To cross reference, all you need do is take the cards just retrieved and poke the rod through a hole for any other category.

The Datasort system is designed for medium-sized projects requiring up to 5,000 cards. Its cross-referencing capability can save up to 80 percent of the time usually spent duplicating and scanning, and 100 percent of the time spent refiling.

The system weighs less than three pounds and is priced at under \$30. For more information, write or call Indecks Inc., Dept. 523, Arlington, VT 05250, (802) 362-3464.

Reader Service - 589

# Loan Sales/Purchase Analysis Program

A new program for analyzing the sale or purchase of a loan is available on disk for the Model I or III with 48K.

The program will calculate either the return on investment or the value of loans of any amount, at any interest rate or due date. It allows both buyer and seller to make knowledgeable decisions when purchasing or liquidating loans.

The printout shows the loan amount, original interest rate, the number of months until due, the yield to the buyer (return on investment), the discount interest rate, the discount amount, and the value of the loan (price paid to seller). Loans in foreign currencies as well as U.S. dollars can be analyzed.

The program sells for \$50 from Realty Software Co., 1116 'E' 8th St., Manhattan Beach, CA 90266, (213) 372-9419.

Reader Service -554

# Cables and Light Pen

Five new cables for the Color Computer are available from Spectrum Projects.



- 1. Find the LOAD 80 dealer nearest you.
- 2. Visit his store.
- 3. Buy LOAD 80.

Once you discover how much time and money you can save using LOAD 80—and just how easy it is to use—you may never want to keyboard another program as long as you live.

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\* Suppliers of Load 80 Disks



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A subsidiary of Wayne Green Inc. Peterborough, N.H. 03458 USA The Disk Interface/ROMpak Extender (\$29.95) is a 40-pin ribbon cable that plugs into the ROMpak port and terminates with a female connector for disk interfaces and ROMpaks. Connectors are gold plated to eliminate corrosion. This three-foot cable eliminates disk I/O errors and makes arranging your components easier.

Three 10-foot extension cables let you place your joysticks, printer/modem, and tape recorder at convenient distances from the computer. They are \$14.95 each. The last cable, a joystick Y adapter (\$19.95), lets you hook in line a joystick and Spectrum's new low-cost light pen (\$14.95).

These products can be ordered from Spectrum Projects, 93-15 86th Drive, Woodhaven, NY 11421, (212) 441-2807.

Reader Service ~569

### Files and Labels

Management System II, a filing program featuring machine-language "lightning sort" of any column, is now available for Model I or III tape-based systems.

File presentation is a maximum of two horizontal lines (100-plus characters) with one to nine vertical columns. Column titles are easily created, and files may be added, updated, listed, deleted, or saved to tape or printer.

A labels command provides printer output of any or all columns for production of mailing labels, file labels, stock bin tags, or any similar home or office application. A merge feature consolidates files previously saved on tape, and a keyed selective-search function lists files based on the number of characters input.

All commands are executed by single-letter entry for faster and easier operation. The program sells for \$26.95 from Micro-80 Inc., 2665 E. Busby Road, Oak Harbor, WA 98277.

Reader Service - 583

# Animation Stand Move Calculator

Animcalc is a program designed to enable the users of hand-cranked animation stands to produce the same smooth, tapered moves generated on the new breed of computer-driven stands. Given the starting and ending

settings of up to six different coordinates, and the frame number at the start and end of the move, Animcalc computes the coordinate settings for each frame within the move, including table rotation (clockwise or counterclockwise).

Each coordinate can be assigned its own taper style (no taper, taper start, taper end, or taper both ends), and different lengths of taper can be assigned to each coordinate. The results can be output to a line printer or the video screen for copying to the animation frame chart.

The program is available in CP/M or Basic for Models I and III. It is priced at \$49.95 (disk or cassette). For more information, write Animcalc, 895 NE 90th Ave., Portland, OR 97220.

Reader Service - 559

### First Down

NFL Pro Football allows play between any NFL teams in either manual or automatic mode. It uses actual NFL rosters and team statistics that may easily be updated as the season progresses. A predict mode produces amazingly accurate forecasts. Fast machine-code graphics add excitement to the game.

This game runs on a 48K Model I or III. Priced at \$34.95, it is available from M-P-Software, Route 2 Box 533, Cumming, GA 30130, (404) 887-6814.

Reader Service -575

### **Bulletin Board**

SPS-BBS is a low-cost bulletinboard system for the Models I, II, and III. The system sells for \$79.95 (\$119.95 for the Model II) and includes a host utility, message system, packed disk files, six functions that can be defined by the system operator, chat mode, and many more.

For more information contact Small People Software Corp., P.O. Box 732, College Park, MD 20740, (301) 937-4339.

Reader Service -587

# Library Management System

The Library Support Option filemanagement system provides the capability to create and maintain libraries for logical organization of files and programs.

The system is compatible with the DOS, user, and application programs. Regular DOS commands can be used to list, print, kill, copy, load, or save files directly to or from libraries. It supports regular as well as library files, and includes faster file handling, one sector minimum file size, and text compression.

Priced at \$79, the Library Support Option is available on disk for the Models I and III from XYZT Computer Dimensions Inc., 2 Penn Plaza, Suite 1500, New York, NY 10121, (212) 244-3100.

Reader Service - 563

# Koupon Keeper

Koupon Keeper is a record-management system for the Models I and III that catalogs cash-off coupons in any order and displays them, at your request, by brand name, product type, amount, or expiration date. This product helps you make better, more effective use of store coupons than is possible using the traditional filing techniques. It also greatly reduces the amount of time necessary to maintain your coupon file.

Priced at \$9.75, it is available from Kensoft, 2102-50th St., Kenosha, WI 53140, (414) 654-2722.

Reader Service -558

# Graph Paper for Your Word Processor

Word-Processor Graph Paper is a software product that produces screen formats of standard graph paper grids compatible with word processor storage formats.

By selecting one of over 30 stored formats, the user need only enter data points and graph titles. The graph then becomes part of the text file and is edited and printed as a normal page.

For more information, send wordprocessor or computer type to ATC Software, RT 2 Box 448, Estill Springs, TN 37330.

Reader Service ~591

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# HOW TO USE YOUR EPSON WITHOUT WASTING COMPUTER

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Your computer is capable of sending data at thousands of characters per second but the Epson can only print 80 characters per second.

This means your computer is forced to wait for the printer to finish one line before it can send the next. A waste of valuable time.

# THE NEW MICROBUFFER™ ACCEPTS DATA AS FAST AS YOUR COMPUTER CAN SEND IT.

Microbuffer stores the data in its own memory buffer and then takes control of the printer. This frees your computer for more productive functions.

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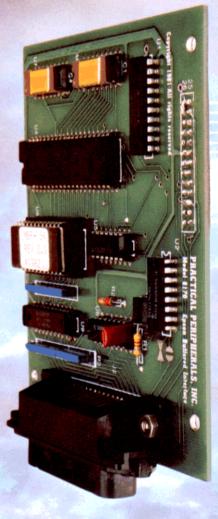
Either model fits the existing auxiliary interface connector inside the Epson MX-80, MX-80 F/T or MX-100 without modification, and is compatible with standard Epson cables and printer control software, including GRAFTRAX-80.

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